THE MARINE ENGINEER;

A MONTHLY JOURNAL OF

MARINE ENGINEERING, SHIPBUILDING,

AND

STEAM NAVIGATION.

EDITED BY WILLIAM GEORGE NEAL, ASSOC. I.N.A.

Vol. IX.—From April, 1887, to March, 1888.

London:
OFFICE FOR ADVERTISEMENTS AND PUBLICATION, 6, AMEN CORNER,
PATERNOSTER ROW, E.C.

1888.

INDEX.

EDITORIAL NOTES.

ILLUSTRATED ARTICLES.

GENERAL INDEX.

OBITUARY.

LETTERS TO THE EDITOR.

BOOKS REVIEWED.

PATENTS.

PARAGRAPHS, NOTES, AND NOVELTIES.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.

VESSELS NOT NAMED.

TRIAL TRIPS.

VESSELS NOT NAMED.

Printed for the Proprietor by H. BLACKLOCK & Co., 75, Farringdon Road, in the County of Middlesex, and Published at the Office, 3 Amen Corner, Paternoster Row, in the Parish of Christ Church, in the City of London.—March 1st, 1888.

The Marine Engineer.

LONDON, APRIL 1, 1887.

EDITORIAL NOTES.

SO little is yet actually known as to the necessary conditions for safety in iron shipbuilding that there is wide speculation left to account for the many mysterious and unrecorded disappearance of vessels in mid-ocean which form a considerable percentage of maritime losses. These losses are generally put down to collision, foundering in a storm by shifting of cargo, or from some such serious cause of disaster. We think it is possible, however, that such serious disasters may frequently arise from the gradual accumulation of a small danger until it reaches a magnitude sufficient to wreck the vessel. Such a danger is the gradual corrosion of plates from the inside of the hull rather than from the outside, and under the cement bottom, where it would not easily be seen. When a ship's bottom is examined for soundness the outside would be chiefly looked to, and the interior examination of the cement would be very likely more or less scamped, owing to the difficulty and unpleasantness of carrying out such examination. Nor do we think that shipowners and captains sufficiently realize the difference of conditions between wooden and iron ships, and the consequent importance to the latter of the cement backing. Formerly in the case of wooden vessels the timber was not likely to deteriorate in any very serious manner within a certain well-known life, and where more or less rotten timbers existed their considerable substance still gave them large coherence so as to avoid sudden disaster. Under the new conditions it must be remembered that the thinness of a ship's plate causes a very small amount of corrosion to absolutely destroy the whole of the cohesion and strength of the plate, should it occur. Iron and steel are very sensitive to the action of many acids, the resulting oxides or salts being invariably without tenacity or strength. The cement backing to the plates is for the purpose of protecting the interior of the plates from the action of any such acids, and from wear and tear. Many descriptions of cargo produce acid solutions which will very readily attack and destroy the iron or steel plates of a vessel; for instance, the molasses of sugar, or the solution of copper pyrites, or even the more or less acid bilge water, are all eminently capable of rapidly destroying iron or steel plates. A vessel, then, carrying such cargoes, depends entirely upon the perfect condition of the cement backing, and if Portland cement of good quality is used, and has not been broken and destroyed by wear or tear, such a backing can be thoroughly relied upon to protect the plating, but it is very difficult now to get good Portland cement. It is at the best but an adulterated mixture, and seldom is sufficient care taken in the selection of a proper fresh-water sand for admixture with such cement. If the cement, then, is only cracked or perforated to a slight degree, all sorts of injurious solutions may readily obtain access to the inside of the plating under the cement, and may eat away the life of a plate in a few weeks or months, such rotten plate eventually causing a leak sufficient to founder the ship. The danger thus of a so-called leak in an iron or steel vessel is enormously greater than in the case of a wooden one. Leakage is not likely to take place between joints of plates as they will naturally close tighter with use and corrosion. Leakage, when it does occur, will probably be an absolute failure of the plate, and may be to such an extent when once the water breaks in, as to founder the vessel before any attempt at dealing with the mischief could be effected. It is wise policy, then, we think, for shipowners to see that they use Portland cement of the best quality, and that the cement is maintained without crack or flaw. Loose bolts or rivets rolling about upon the cement will often be sufficient to cut up the cement, and crack it where it is of inferior quality. Such matters can be best confirmed by close examination of iron vessels in the graving docks, and we have no doubt that the practical experience of many of our readers will be able to confirm our views as above expressed, that many vessels safely reach home with a condition of plating through abnormal corrosion, which would, with a little more strain upon such plates, have produced a leak sufficient to founder the vessel.

WE have before us the draft rules of a newly-established Marine Engineers' Union, whose offices are at 91, Minories, E.C., and of which we note that the well-known sea-going engineer Alexander R. Leask is honorary chief secretary. We understand that this Union has now been fairly established and is likely to be successful; and as far as can be ascertained from their proposed draft of rules, it is likely to fulfil the requirements of a club: bringing sea-going engineers into mutual communication with one another, and to give them a corporate status which will no doubt serve to enhance their present position as professional men. The Union, we see, proposes to open branches at all the principal ports of England and Scotland, as well as at Antwerp, and probably at other foreign ports as time

progresses. There is no doubt that sea-going engineers can add largely to the value of their professional knowledge by frequent intercommunication, and as they are essentially men who travel from port to port, it is well that they should have representative clubs at such ports, where they could feel more or less at home among their own associates. We see that these objects are kept prominently in view under the proposed operations of the Union, the head-quarters in each case forming a handsomely-furnished club house, with suitable accommodation both for mind and body of the members, under the superintendence of a resident house-steward. That none of the officers who have been active in the organization of this society are paid officers is an excellent guarantee of the bona-fides of the whole association, and that it will be conducted for the benefit of the members rather than for the benefit of any individuals. So far, we ourselves have, as, doubtless, all interested in the shipbuilding or marine engineering trades will have, full sympathy with the movement, and will wish it every success; and for our part, our pages will be opened as heretofore to any correspondence or technical discussions which members may desire to publish. We note, however, that the title of the association is a somewhat ominous one, as possibly indicating a trades union for the purpose of trade advancement rather than for the purpose of good fellowship. It is difficult at such an early stage to form any opinion as to what purposes such a union, which may become a very powerful one, may tend, but we trust that the club house movement, which we think most excellent, will be kept permanently to the fore, and that such an association will not allow itself eventually to bear such a questionable relation to the shipbuilding trade at large as many trades unions do to other trades at present. We see that the views of the organizing committee are that some degree of qualification should be necessary for proposing members by way of certificate or otherwise; and this we think very proper, as marking it essentially as an association of professional men, whose claims to recognition rest on no doubtful basis. This is undoubtedly the way to raise the profession of marine engineering to the same footing as that of mechanical and civil engineering, which have their respective institutes largely supported by the members of the profession, and whose existence serves no doubt largely to raise the members of such profession to a fully recognized social and professional position. This is greatly to be desired for sea-going engineers as a body, and we think the present movement is one most calculated to attain that end.

The submarine torpedo-boats for Turkey, designed and constructed by Mr. Nordenfeldt, which have lately undergone their trials at Constantinople, seem in every way to be satisfactory as regards their construction and the performance of their work. It will be remembered that in a former issue we gave some account of an American invention which produced the heat necessary for motive power by means of caustic soda. Mr. Nordenfeldt, however, relies entirely upon steam pressure of the ordinary type for effecting the raising and lowering and driving of his submarine boat. This he effects by the employment of a reservoir in which a large quantity of heat is stored up in a volume of water by direct communication with the boiler whilst the boat is running above the surface. When the boat descends and further combustion becomes impossible, the reserve force thus stored up is utilised for driving the engines. The descent is caused by two vertically acting screws worked by separate engines, and is maintained in the horizontal line by movable fins at the bow. There is thus no displacement of weights and receipt or discharge of water into or from the ballast tanks, but the whole movements of the Nordenfeldt boat are managed by the simplest mechanical action. The propelling screws are placed centrally in the axis of the cigar-shaped boat, but in order that a vertical marine engine of the usual type may be used the propeller shaft is jointed by two universal couplings, and thus brought down to the bottom of the hold of the vessel. The side vertical screws are driven by engines of the three-cylinder type, so that there may be no dead centre, the steam for which passes through a valve of peculiar construction, and worked by the captain of the boat. He can thus vary the speed of the propellers or stop them both together or separately at will, and thus arrange the depth at which his craft is to move. The placing of the propeller in the axial line of the boat, which is a new improvement, was found by Mr. Nordenfeldt to be of great importance, as tending to maintain the boat horizontally when travelling under the water, the driving power being thus at the centre of gravity. The maintenance of the horizontal position under the water also depends upon the bow fins, which are connected to a plumb weight and other mechanism extending to the conning tower, so that the action of these fins is rendered both automatic for maintaining their horizontal position and controllable, so that they may be set at any desired angle. Should any accident happen to the driving or lowering mechanism, it is obvious that the vessel under the Nordenfeldt plan will come to the surface by reason of its own buoyancy. Before the boat descends under the

water it is necessary to hermetically close the furnaces, which is done by certain doors over the furnace front, upon which combustion is soon brought to an end. The small portion of funnel is removed, and doors are placed over the uptake and on the main hole of the shell of the boat so as to completely close all ingress of water into the boat or egress of fumes from the furnace. Whilst these changes are being effected, water is allowed to run into the ballast tanks to reduce the buoyancy to its proper limits and the conning tower is then hermetically closed up. When the vertical acting screws are set in motion, the boat may be lowered to any desired depth under the water, or she may be sunk so far under the water that nothing but the glass cupola of the conning tower remains above the surface. The official trials will take place as soon as the torpedo fittings have been completed, and we shall then have a more detailed account as to the performances of these boats.

FROM a letter lately addressed by the shipowners of the Port of London to the Thames Conservators there seems to be on the part of the former great dissatisfaction with the Port of London as regards its accommodation for the present enormous traffic, which in 1885 amounted to upwards of twelve million tons. The chief difficulty of which the shipowners complained is the impossibility of vessels of deep draught anchoring in the navigable channel between Gravesend and the docks without going ashore. Vessels therefore are compelled to continue moving so long as they are in the Channel, even in dense fogs. The only apparent remedy for this state of affairs would be to entirely alter the conditions of the navigable channel of the Thames over some six or seven miles of its length. The navigation of the Thames below Erith is, at low water, exceedingly intricate, and its intricacies have given rise to the employment of a highly-skilled body of pilots, whose business it is to know the ever-varying condition and position of its sand, gravel, or mud banks. To clear out the whole of this reach of the river so as to render it of a minimum draught of 26ft., which appears to be the demand of the shipowners, would be a gigantic undertaking. Nor does the experience gained in other tidal rivers render it a matter of confidence that even were such dredging effected it would remain permanent over any period of time, or would not set up the removed bars at some other point in the river farther down. We think also that the carrying out of the idea to any great extent of vessels anchoring in the Channel would greatly multiply the collisions likely to take place in the navigable channel between the anchored vessels and those which might be desirous of proceeding. This evil might become of such large magnitude that it might be necessary, even after the expense had been incurred, to establish a bye-law that vessels should not be permitted to anchor in or near the navigable channel of the river. In spite of the drawbacks of the Thames channel thus referred to by the shipowners, the enormous present traffic of the river seems to be fairly well accommodated, as we do not remember to have seen many recorded mishaps for want of the convenience of being able to anchor in the navigable channel as proposed. This evil, therefore, is either a very trifling one, and thus in no way commensurate with the enormous cost of re-forming the bed of the river; or if it is really a serious evil, it would, doubtless, be as well or better met by the establishment of commercial docks lower down the river, as in the case of the Tilbury Dock. We have never heard yet of so extensive a patronage being extended to the Tilbury Docks as would serve to prove that the dangers of the narrow reaches of the Thames to shipping are very serious. In fact, we are inclined to think that the docks nearer the port of London would pooh-pooh the idea of any serious danger to large traffic existing in the navigable channel of the Thames. We have no doubt that were such a scheme possible to be efficiently carried out as suggested by the shipowners, it would largely increase the facilities and accommodation of the higher port of London, but as the cost would be an enormous one, the important question still remains whether it would not pay better for the dock accommodation to move down the river rather than to attempt artificially to bring an improved river bed up to the existing dock accommodation. We do not think the shipowners have any idea of the cost of the work proposed in their letter.

A NEW ZEALAND DREDGE.—A dredge, built by Messrs. Kincaid, M'Queen and Co., Dunedin, for the Bluff Harbour Board, was recently launched, and named the *Alpha*. The material used in the construction of the *Alpha* was, of course, imported. She is built entirely of mild steel, and her dimensions are:—Length, 50 ft., overall; breadth of beam, 15 ft.; depth of hold, 6 ft. 6in. She is capable of raising 75 tons of spoil per hour at a depth of 18 ft., and will, therefore, be peculiarly applicable for dredging purposes in such a river as she is intended to work in, its bottom being shingly and shifty. Her engines, which are also constructed by Messrs. Kincaid, M'Queen and Co., are high-pressure, of 70 H.P., the diameter of the cylinder being 8½ in., and the length of the stroke 12½ in. The *Alpha* is fitted with a multitubular steel boiler 15 ft. 6 in. long, and 4 ft. 8 in. in diameter, with 38 tubes, each 3 ft. in diameter. Her boilers stand a working pressure of 80 lb. to the square in. and have been tested and certified to a pressure of 160 lb. to the square in. She has a screw propeller, and is fitted with a rudder on each quarter in order that she may be the more easily handled. Her decks are planked with kauri pine.

ON TRIPLE-EXPANSION MARINE ENGINES.*

ADJOURNED DISCUSSION.

MR. MORRISON, replying upon the debate on Mr. Robert Wyllie's paper, read at the last meeting of the Institution of Mechanical Engineers at Leeds—as reported in THE MARINE ENGINEER, vol. 8, page 291—said it was now generally recognized by shipowners that the triple-expansion engine on three cranks was very economical from a wear-and-tear point of view; and although tandems were still advocated by many engineers, there was no doubt that the three-crank was preferable. Looking at the question generally, there was naturally a decided inclination towards the three cranks, as it might reasonably be expected that the motion was more uniform and the wear and tear less. The experience of the last three years proved that that assumption was correct, as they saw owners who had two-crank tandems and three-crank triples were discarding the former and continuing the latter design. I was certain that in converting the present compounds into triples the tandem arrangement would in some cases have to be adhered to, and he thought a very good solution of the problem was to put a cylinder on each of the present existing cylinders, and use quadruple-expansion with, say, not less than 170 lb. steam pressure. That would make very little alteration in the present engines, and the high ratio of expansion which would be required for the present L.P. cylinder to be retained must be conducive to the economy of fuel. Experience had shown that a compound tandem was not so economical as two-cylinder receiver compound with cranks at right angles. Then why should a tandem triple be as efficient as a receiver triple? With a tandem engine there was more connection between the cylinders during expansion than in the receiver engines; and as this meant that the temperature of the steam in the small cylinder must fall to that of the large one, and as the whole intention of compounding an engine was to reduce the range of temperature and the consequent condensation and re-evaporation, it appeared to follow that the receiver engine would, other things being equal, be the more efficient. There certainly did seem to be a great difference of opinion regarding the best ratio of cylinders for a triple-expansion engine, but considerable latitude was due to the requirements of the case, as they should not expect to find the same ratio in an economical land engine, where weight and space were not valuable, as in a man-of-war, where the reverse was the case. For instance, in an economical land engine, which would probably aim at an absolute terminal pressure, say, of 6 lb., which would give a ratio of high pressure to low pressure of 1 to 8·5 or 9; whereas in a man-of-war, where the range of power required to be large, the terminal pressure would be about 12 absolute, and the ratio of high pressure to low pressure would between 5 and 6. He had constructed a diagram to show the effect of twisting moments by taking into account the weight of moving parts and the pressure required for their acceleration. It would be seen that those engines being comparatively low speed engines the pressure required to accelerate the moving parts was not great, and the difference produced by it upon the diagram of twisting moments might be neglected for purposes of comparison. He might say that that was why the weight of moving parts had been neglected in the calculations and curves given with the paper. The late Mr. Wyllie thoroughly appreciated the valuable data which would be obtained if the weight of steam used could be ascertained—in fact, it was so stated in the paper; but all marine engineers would agree that it was sufficiently difficult to get the usual diagrams of coal consumption on board a steamer, and although those results were only approximately correct, they served to indicate the efficiency of the machinery generally. Everyone would agree that correct data would be valuable, and he was sure that the firm with which he was connected would gladly give Professor Kennedy every assistance to obtain some. As it would be obviously unfair for Professor Kennedy, after having said that some of those results were impossible, not to substantiate his statement, he hoped he would be able to arrange a trip, say from Hartlepool to Plymouth, in one of their ships, taking the diagrams and measuring coal throughout the trip, and he would gladly undertake to give him every assistance, but could not undertake to introduce any feed-water measurer or anything that would interfere with the working of the ship. Those results could be made known at the next meeting, and would be both interesting and instructive. With regard to the roughly approximate results for which he was directly responsible, when those results of the *Para* were taken it was entirely for the information of the late Mr. Wyllie and the firm he represented, and with no idea of publication, so that they might rest assured they were not what engineers termed "cooked" in any way. He used three special indicators, and with the assistance of the chief engineer took diagrams at what was practically the same instant at regular intervals throughout the seventy-two hours. He kept the steam steady, weighed the coal and ash, and in fact did his very best to get a good idea of what a triple-engine was going to burn. Of course there were not many triple-engines afloat then. The whole of the diagrams were correctly worked out, the boat burnt the same amount, and travelled the same speed now as then, and had done so ever since. Taking the *Para's* cards by Professor Kennedy's methods, they found the H.P. showed 13·25 lb. of steam used per I.H.P. per hour, the I.P. 11·5, and the L.P. 8·9. Now, if they took Professor Kennedy's figures they had 13·25 + 2·35 = 15·60 lb. of steam in the H.P. when there was only 8·9 shown on the L.P., thus leaving 43 per cent. to be condensed. This he should term rather an uneconomical engine, and he had no doubt that if Professor Kennedy calculated by the same method the water consumed per I.H.P. with any published diagrams from triple-engines, he would get more results which he would declare impossible. Professor Kennedy said the water shown in the indicator diagrams was 85 per cent. of the total water, and to find the total water added 15 per cent. of what he at present has. He did not get the water by this method. Let x = water shown by cards, then by Professor Kennedy

$$x + \frac{15}{100}x = \frac{100}{85}x$$

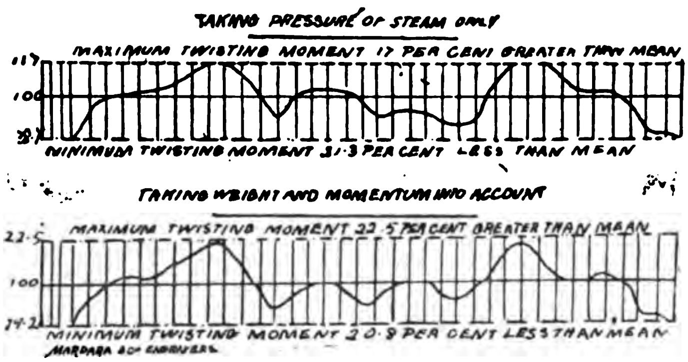
$$\frac{115}{100}x = \frac{100x}{85}$$

$$97{\cdot}75\,x = 100{\cdot}00$$

If they took the *Para* in Professor Kennedy's table, the ratio should be

$$85 : 100 :: 16{\cdot}1 : x$$

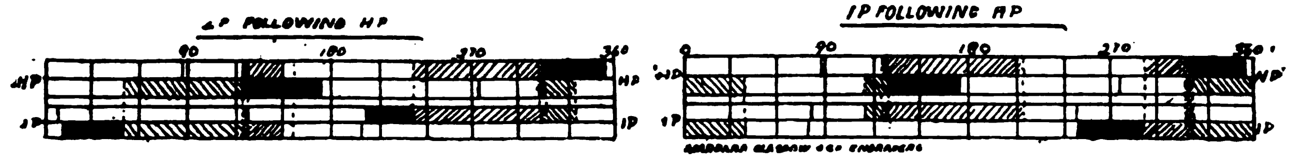
$$x = 18{\cdot}9 \text{ and not } 18{\cdot}5.$$



TWISTING MOMENT ON CRANK SHAFTS.

* *Paper read before the Institution of Mechanical Engineers.*

He would like very much to know the way in which Professor Kennedy arrived at his figures. He differed from Professor Kennedy with reference to the table, because he thought instead of adding the portion of the clearance space he had not taken into consideration the difference of pressure, and he should bring down the pressure due to the end of the compression curve, and consequently he would have to take a certain amount from the volume V, and not add it to V. He, Mr. Morrison, was not at all in favour of taking the lbs. of coal per I.H.P. as the one entire basis for estimating the general efficiency of the machinery, as the available latitude in dealing with diagrams admitted of so many inaccuracies. Steamers of a certain class, and of approximately similar dimensions, should also be compared, that is, the deadweight carried a certain speed on a certain consumption, and they then had the commercial value of the results; and, after all, the £ s. d. question was the one to be considered. Regarding the *Lusitania*, on the return Australian voyage, she evaporated about £1,000 less out of the shareholders' pockets than on any previous voyage, and in the latter case, of the Union Company's s.s. *Spartan*, the saving on a return Cape voyage was 500 tons, representing a monetary value of £750, and taking four voyages a year, that is, of course, £3,000 a year; and as a proof that this had been appreciated, Messrs. Richardson have just finished the *Athenian*, are busy with the *Trojan* and *Mexican*, as well as Sir Donald Currie's steamers the *Grantully*, *Garth* and *Drummond Castles*, the whole representing a total of nearly 27,000 I.H.P. Professor Kennedy remarked, with reference to the *Anglian*, that the advantage given by triple-expansion was in a perfectly legitimate way, by using higher boiler pressure and taking additional work out of the steam by expanding it. Of course that was so. Then further, he said, it did not prove that three cylinders were better than two; what it did prove was that it was better to use 150 lb. than only 50 lb. It appeared to him that what it proved was that a three-cylinder triple-expansion engine was an economical per cent. of its stroke. At 295 deg. the H.P. top began to exhaust into the I.P. bottom, and shortly after the H.P. bottom began also to exhaust into the I.P. bottom. This continued till the H.P. crank had got to 42 deg. in the next revolution. Steam was then compressed into the receiver from 42 deg. to 110 deg., during which period the H.P. piston had passed through a distance equal to 57 per cent. of its stroke. Thus, with the crank arranged, H.P., L.P., I.P., the mean compression into the receiver was 19·5 per cent. of the stroke; with H.P., I.P., L.P., it was 56·5 per cent. The compression in the first case was just what was required to keep the receiver pressure practically uniform, in the other case the compression caused a variation in the receiver pressure, in some cases of 22½ lbs. Mr. Mudd, in his classification of sources of loss, said, that one of the principal sources was the excess of condensation over re-evaporation, and this it was attempted to minimise by reducing the range of temperature in any one cylinder; yet he said that consideration respecting the detrimental effect of condensation during admission had led him to conclude that oblique lined diagrams were preferable to those having horizontal lines, although he acknowledged that the oblique diagrams had the greater range of temperature. It appeared to him to be evident that the reduction of the range of temperature was essential to maximum economy. Again, considering the initial load it was clear that the greater the load the greater should be the crank pin and main bearing surfaces; consequently, for a given pressure per square inch they would require larger bearings with the oblique diagram than with the horizontal. Although many engineers commenced with the sequence H.I.L., all the leading firms in the kingdom were now adopting that advocated in the paper, and it was acknowledged by engineers at sea who had experienced both plans that H.L.I. made what was commonly called the sweetest running engine. Mr. Mudd's remarks as to the necessity for care in designing the steam passages throughout the engine, in order to obtain equality



SEQUENCE OF CRANKS.

engine for using steam at a pressure of 150 lb. Of course, the work was in the steam, and not in the three cylinders, and, of course, theoretically one cylinder was as good as three. Still, a steam engine should not be considered in its purely theoretical aspect, since the chief source of loss in all engines, that due to initial condensation, was the very thing overlooked in such theoretical considerations. It was the reduction of this loss, due to the minimum of cooling from the cylinder surfaces, which made a three-stage expansion engine superior to even a simple condensing engine. The sequence advised in the paper was H.P., L.P., I.P., and that advised by Mr. Mudd was H.P., I.P., L.P. Now the question was, which was right? The former sequence gave an approximating horizontal exhaust line, and thus minimised the range of temperature and initial loads; the latter increased the range and also the load. He had prepared a diagram to show the manner in which the sequence of cranks affected the passage of steam between the cylinders. This showed the L.P. followed the H.P.:—that was to say, the angle between the H.P. and I.P. was 240 deg. Looking at that diagram, let them suppose steam admitted to the top of the H.P. cylinder, the H.P. crank moved through 122 deg., when it began to exhaust into the I.P. It continued exhausting into the H.P. till it had passed through 162 deg. From 162 deg. to 232 deg. the steam was compressed into the receiver, and during this compression the piston passed through 23 per cent. of its stroke. At 232 deg. the bottom of the I.P. took steam, and continued to do so until the H.P. had passed through 335 deg. The H.P. then compressed into the receiver from 335 deg. to 50 deg. in the next revolution, and during this the piston passed through a distance equal to 16 per cent. of its stroke. Taking the other sequence of cranks and looking at the diagram, they would see that the H.P. crank passed through 122 deg. as before, when it began to exhaust into the I.P. top, which had been previously open. It continued exhausting into I.P. top till the crank got to 215 deg.; the steam was then compressed into the receiver from 215 deg. to 290 deg. during which the piston passed through 56 in the powers, temperatures, and stresses, were the same in effect as if he had said that the object of a ferry boat was to reach the middle of the stream. So it was; but still it was naturally achieved in crossing to the other side. So the equality in power, &c., was obtained by designing the steam passages so that the steam was got "freely on to the piston and freely off again at the proper times." He was sorry Mr. Mudd had given them a rule-of-thumb for ratios of cylinders, which he said had the merit of being easy to remember, as in his—Mr. Morrison's—opinion rules-of-thumb and scientific progress were not in harmony. The ratio 3, 5, 8, was the approximately accepted one for the ordinary class of cargo steamers, viz.:—

$$\frac{\text{H.P.}}{\text{I.P.}} \quad \frac{1}{2\cdot 66}$$

$$\frac{\text{H.P.}}{\text{L.P.}} \quad \frac{1}{7\cdot 11}$$

He desired to thank Mr. Adamson for reminding them that the present paper was comparative rather than absolutely theoretical, as that had been lost sight of frequently in the discussion. Professor Smith was perfectly right in saying that if the range of temperature in each cylinder was fixed, that fixed the range of pressure, and if the cylinder ratios were so fixed with this pressure as to give equality in the powers concurrently with those two other conditions, what was meant by the statement in the paper was that an approximate equality should exist between those three conditions, and the nearer to absolute equality the better. It was, however, incorrect to say that if the conditions of equality of mean pressure had been substituted, the two first conditions would have included the third. Equality in mean pressure was not equivalent to equality of H.P., as in two cylinders of different areas to give the same power, at the same piston speed the mean pressure must be in inverse proportion to their area, not equal.

In reply to Mr. Cochrane as to the lineal velocity per second on which he based his calculations for those outlets and inlets from

the cylinder according to their different diameters or pressures, Mr. Morrison said to get the steam velocity, he took the area of the cylinder, multiplied it by the piston speed in feet per second, and divided it by the area of the port opening. In the various engines illustrated in the paper, the initial speeds of steam were about H.P. 100, I.P. 200, L.P. 250; and the exhaust H.P. 90, I.P. 120, L.P. 140; in some cases they have gone as high as 160 in the L.P. cylinder exhaust, and found no appreciable detrimental effect.

Mr. Morrison having thus replied, as representing the late Mr. Wyllie, to the discussion on the paper when read at Leeds, the Chairman called upon Mr. W. W. Beaumont, who, referring to some remarks made at Leeds tending to discredit the indicator diagram and coal consumption figures obtained at sea with triple compound engines, ventured to say he thought they ought not too lightly to throw away the information obtained at sea by engineers and by shipowners, and that the constructors of engines ought to be guided as much by the requirements of the shipowners themselves as by the information obtained from indicator diagrams. He hoped no one would think that he wished to under-estimate the value of the information to be obtained from indicator diagrams. and as to the quantity of steam used; but, at the same time, he thought that the information obtained during numerous voyages or by observations taken over large numbers of hours was really valuable, and gave important comparative information by which they might judge of the relative economy of different kinds of engines. In the remarks made by Professor Kennedy, he said, amongst other things with reference to compound and triple-cylinder engines, that there was no reason theoretically why the high pressure in the case mentioned should not have been as well utilized in the two-cylinder compound engine. Now it was a question very much of what was taken into consideration as theory. He thought that that was theory which took into consideration practical conditions, as well as those which, in the case of a diagram, would relate to a consideration of the behaviour of steam, very much as though a gas. There was no doubt whatever that the triple-expansion engine was more economical than the ordinary compound engine, but of course, if they chose to take special cases, they might show that a compound engine had given results as good as any triple-cylinder had yet, but they had to take engines generally, of the same class, and doing the same work. For instance, they might bring forward cases in which a single cylinder engine had, under special conditions, produced results as economical as, he believed, any compound engine of to-day had produced, but no one would care, he thought, to argue that theory indicated now that they could do as well in one cylinder as they could in two, and if theory indicated anything at all, when the practical conditions under which steam had to be used were taken into consideration, and steam looked upon as a thing that had to be used in a conducting cylinder, it showed that the ranges of temperature in any one cylinder must be reduced as much as was consistent with a moderate number of cylinders. He therefore repeated that the information obtained by shipowners which showed them what it costs to take a certain quantity of cargo from here, say, to Australia, was, after all, the information that was most important, and was that which must be used by engineers in selecting their type of engine.

(To be concluded in our next number.)

The Dee Oil Company, Saltney, have just secured the whole of the Admiralty contracts for oils for internal lubrication, that is to say, for cylinder oil.

Messrs. Alex. Wilson and Co., of the Vauxhall Ironworks, Wandsworth Road, London, have just completed a triple-expansion surface-condensing launch engine for the Admiralty, which up to the present time is the smallest in the service. It is fitted in one of the service launches at Devonport Dockyard, the high-pressure cylinder being only 6 in. diameter, and the I.H.P. attained on the trial being 72.

One of the largest grab-dredgers made by Messrs. Priestman Brothers is about to be sent to the Panama Canal, by order of Messrs. Fontan and Tedesco, of Paris. This dredger is only to be used for lifting blasted rock. The Canal Company's engineer inspected one of these machines working at the new entrance of the Royal Albert Dock lifting the blasted concrete of the wall which was blown up last year, as described in our pages. The trial was so satisfactory that he recommended the directors of the company to adopt this system on the Panama Canal.

THE MODERN MARINE ENGINE AND BOILER.

The usual monthly meeting of the London Association of Foremen Engineers and Draughtsmen was held in the Cannon-street Hotel on March 5th, at 7.30 p.m. After the usual routine business, the Chairman stated that the committee had arranged for their annual festival to be held on the 30th April, when Lord Thurlow had promised to preside, and they expected several other distinguished guests. A paper was then read on "The Modern Marine Engine and Boiler," by Mr. Walter Swanson, a chief engineer in the merchant service. Mr. Swanson stated that there was no better way of proving the immense improvements made in marine engines than a comparison of the fuel consumption in the early engines with that of the latest triple cylinder expansion engines. This result was very largely due to our better knowledge of boiler making, for although the advantages of high pressures and large expansion had long been known, it was only recently that reliable boilers could be produced to carry 150 lbs. at sea. The present arrangement was considered very good, but he thought, with the improved appliances now in use, both for producing the material and working it into shape, we would soon hear of boilers capable of working at 400 lbs. or 500 lbs., and we should then require a different type of engine to utilise such a pressure. He considered in detail various types of marine boilers in use, giving the preference to the ordinary cylindrical wet bottomed boiler with smooth flues. He said corrugated furnaces were very good when new and clean, but when in regular work the corrugations filled up with scale, and he had seen some that had been a considerable time at sea with very little scale on the high parts, but the hollows filled up so that the top surface was nearly straight. He said the marine engine had more trying duties to perform than any other, as it must be readily and easily started and reversed, whatever the weight or horse-power, and also be able to work continuously for very long periods without stoppage. He mentioned different types of engines, but preferred the triple cylinder three-crank engine, as combining these qualities with economy in cost of working better than any other. He considered in detail the principal parts of the engine, and mentioned some of the difficulties encountered by sea-going engineers, with suggestions for their removal. He gave a graphic description of the breaking of a screw shaft in stormy weather, and how they repaired it so as to be able to steam slowly to a port about 400 miles distant, and suggested that all shafts before being put in should be tested with a twisting strain at least twice as great as the maximum power of the engine, and should be re-tested after any serious accident. In speaking of condensers, he urged the adoption of a simpler way of securing the doors, as in the event of a leak at sea—no uncommon occurrence—it was no easy task to unscrew 70 or 80 bolts and secure the doors in heavy weather. The same remarks might apply to the air-pump, which in many cases has no provision made for removing the valves or examining them without removing all the gear immediately above the cover of the pump. After describing different sorts of air-pump valves, he eulogised Thompson's patent metallic valves as a boon to sea-going engineers. He mentioned the necessity of a good, reliable reversing apparatus, as a ship ought to be stopped and made to move full speed astern in thirty seconds, and he had seen it done in fifteen seconds from the time of the engineer commencing to perform the evolution by the use of patent reversing gear. Several of the members, including Messrs. Douglas, Coates, Stokes, Reid, and Heath, commented on the paper favourably. Mr. Douglas stated that his firm—Thorneycroft and Co.—had lately been perfecting a steam generator—he could not call it a boiler—which he thought would soon be heard of. They had put one in a torpedo-boat, which kept steam up easily without forced draught, and some of the representatives of foreign Governments present at the trials were so well satisfied that they had ordered several similar The Chairman summarized the discussion, and after a vote of thanks to Mr. Swanson, the meeting closed.

Delta Metal Valves.—The three following steamers were fitted with Beldam's corrugated valves in Delta metal:—s.s. *Kent*, after steaming 170,000 knots, the valves are still in good working order; s.s. *Rewa*, now on her eleventh voyage to Calcutta with the same valves; s.s. *Sussex*, the same valves have been in use for over two years; still in good working order.

NEW ARMOURED CRUISER FOR THE SPANISH NAVY.

On February 24th there was launched from the shipyard of Messrs. J. & G. Thomson, Clydebank, a new Spanish cruiser named the *Reina Regenté*, of which our illustration is a general external view as she is intended to float when finished. This vessel was contracted for after the leading shipbuilders in Britain and other countries had submitted competitive designs to the Spanish Government, the designs submitted and since carried out by Messrs. Thomson being adopted. Among the conditions laid down by the Spanish authorities to be fulfilled in this vessel were that she was to be of the protective deck type, the deck having a thickness of 3¼ in.; to have four 20-centimetre 12-ton guns, six 12-centimetre guns, and a numerous small armament; to be able to maintain a speed of 19 knots, and to have a radius of action of 5,500 knots. These stipulations have been much more than met in the vessel as constructed, her builders having arranged for a protective deck of 4¾ in., four 24-centimetre 21-ton guns, six 12-centimetre guns, a speed of 20½ knots, and a radius of action of as much as 12,000 knots. The *Reina Regenté* is 330 ft. long, and in fully equipped condition she will displace 5,600 tons, although her usual sea-going displacement will not exceed 5,000 tons. She is of steel throughout, and depends for her protection in an engagement partly upon the armoured protective deck, and partly upon the unusually minute sub-division of the hull between this deck and the one above it, or, in other words, of that part of the ship between wind and water. This part is divided into no fewer than 83 separate watertight compartments, most of which will be used as coal bunkers. The space below the armoured deck is divided into 60 watertight compartments, and for the whole length of the vessel a cellular bottom is fitted. The total number of watertight compartments in the ship is 156.

The vessel will be propelled by twin-screws, the engines, contained in separate watertight compartments, being of the horizontal type, triple-expansion. The boilers, four in number, are also in separate watertight compartments. Well above the waterline there are two auxiliary boilers, supplied by Messrs. Merryweather, for raising steam rapidly in cases of emergency. These boilers are connected to all the auxiliary engines on board, which altogether number no fewer than 48. In addition to the two sets of main engines there are two starting engines, four centrifugal pumps, bilge and fire pumps, feed pumps, ten fan draught engines, steering engine, capstan engine, two electric light engines, two boat hoisting engines, also ash hoisting engines. The four centrifugal pumps are connected to a main pipe which runs right fore and aft, receiving branches from every compartment. The branches are so arranged that the compartments are always in connection with the pumps, and if they become flooded are immediately pumped out; but if water seeks to enter the compartment from the pipe, it is at once prevented by an automatic valve. Should it be desirable, however, to flood any compartment the action of this valve can be suspended. The automatic nature of this pumping arrangement should be of the greatest value in an engagement, when men have little time and little power in which to think and act.

The highly important quality of turning power has received special attention in this new cruiser. The patent sternway manœuvring rudder of Messrs. Biles and Thomson, introduced with very marked success in the recently-built Spanish torpedo-cruiser *El Destructor* and the Russian torpedo-boat *Wiborg*, is again a noteworthy feature in the new vessel. This contrivance, it may be mentioned, is a combination of a partially balanced rudder with a rudder formed as a continuation of the after lines of a ship. The partial balance tends to reduce the strains on the steering gear and thereby enables the rudder area to be increased without unduly straining the gear. The armament of the *Reina Regenté* is, for her size, very formidable. It comprises four 24-centimetre and six 12-centimetre Hontorio guns, six 6-pound Nordenfeldt guns, fourteen small guns, and five torpedo tubes. On the main deck, right forward, there are two torpedo tubes, there is one aft and one in each broadside amidship. There are four gun-towers on the level of the main deck, but projecting beyond the side of the ship. Each of the two forward ones fire five degrees across the bow, and to within 30 degrees of right aft. The after guns have a similar range round the stern. The remainder of the armament is placed on the upper deck. At the fore end there is a platform, about 4 ft. above the deck, upon which two of the 21-ton Hontorio guns are placed. These fire right ahead, and to within 40 degrees of right aft. A similar platform right aft receives the other two 21-ton guns. Between these two platforms, and ranging along both sides, are placed the six 12-centimetre guns, two of which fire forward, two aft, and the remaining two have a range of 140 degrees. Besides the six Nordenfeldt guns, there are two 37-millimetre Hotchkiss revolving guns, and of the smaller guns there are five for boat and field service, and four for working from the mast heads. The vessel will be fitted with accommodation on the main deck for 50 officers and about 350 men. The launch took place from Messrs. Thomson's yard in the presence of a large assembly, the naming ceremony being performed by the Duchess of Wellington.

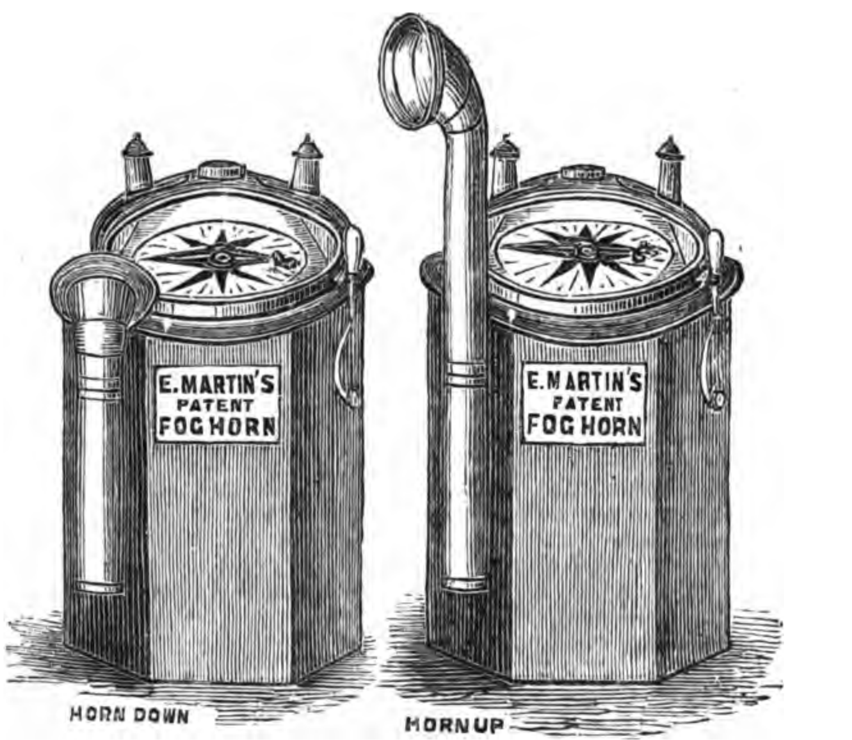
PATERSON'S PATENT BUILT-UP CRANK SHAFTS.

The built-up crank shaft illustrated by the accompanying engravings is so designed as to admit of any single part of the shaft being replaced, should a break or fracture occur at that particular part, without in any way having to disturb the whole of the shaft and numerous bearings, as is required when a break occurs in a shaft of the ordinary construction. As will be seen on reference to the illustrations, of which Fig. 1 represents the webs in their entirety, and also the separate parts sectionally, while Fig. 2 shows a single-throw flexible shaft, designed for a paddle steamer, each of the webs consists of two separate parts. The smaller part is so constructed as to half encircle the end of the shaft, to which it is rigidly secured by a large set bolt (best seen in Fig. 2) and two deep feathers. The larger part of the web also encircles half the shaft, and is so recessed as to allow of the smaller part fitting accurately within it, the two pieces when properly adjusted on the shaft being firmly bolted together *in situ*, as shown in the

sectional illustration, a slight taper on each part serving to jam them together when bolted up.

The crank pins, as shown in the figures, are formed with a shoulder at each end to prevent their moving endwise, except in the case of a flexible shaft, when the webs and pins form a ball and socket joint, as in Fig. 2. This latter arrangement not only gives the shaft a large degree of flexibility, but also allows of the shaft being run in bearings which have been considerably worn down. These shafts can be conveniently stowed, in parts, in the engine room, and owing to the comparative smallness of the different parts sounder and cheaper forgings may be relied upon.

Mr. J. M. Paterson, of North Shields, is the inventor of this shaft.



E. MARTIN'S PATENT FOG HORN.

MARTIN'S PATENT FOG HORN.

THE accompanying illustrations show a novel departure in the construction of fog horns that has recently been patented by Mr. E. Martin, of 63, Garford Street, West India Docks, E.

At a recent trial of the merits of the new fog horn, attended, amongst others, by representatives of the Admiralty and the Board of Trade, Mr. Martin incontestably proved that his horn gave forth a more distinct sound when compared with two horns of the ordinary pattern. Further, the action was decidedly more reliable, and the results were attained with a minimum of exertion on the part of the operator. Briefly, the apparatus consists of a horn mounted on the side of a wood or iron box, the binnacle being utilised for the purpose, as shown in the accompanying figures. Inside this box is placed a small pair of circular bellows, similar to those employed in portable blacksmith's forges. These bellows are actuated by the handle shown on the right hand side of the box, and supply their air to the horn by means of a simple valve. This valve is provided with a spindle which passes up through the top of the box, and is surmounted by a stud. Normally, the valve remains closed and the supply of air is shut off from the horn. If now a stroke or two is made with the handle and the stud is then depressed, a sharp, clear, and well defined, or prolonged blast is produced, according to whether the stud is only momentarily depressed, or is held down for a considerable time, there being no limit to the length of the blast, provided the bellows handle is kept working.

It will thus be seen that by proper manipulation of the stud any desired combination of long and short blasts can be readily effected, and the instrument worked to fulfil the requirements of any desired code.

The instrument can be readily worked by one man, and, as shown, it takes up practically no space; it is always at hand when wanted, and has no loose parts, which somehow always manage to be out of place just when they are wanted.

The whole arrangement is strongly made, and as there is nothing in it to get out of order will stand rough usage. We commend the invention to the notice of all shipowners, and trust it may receive that measure of support of which it is well deserving.

The Turkish Government has placed an order with the Barrow Shipbuilding Company for two submarine torpedo boats similar to the one they have built for the British Government

Fig. 2.

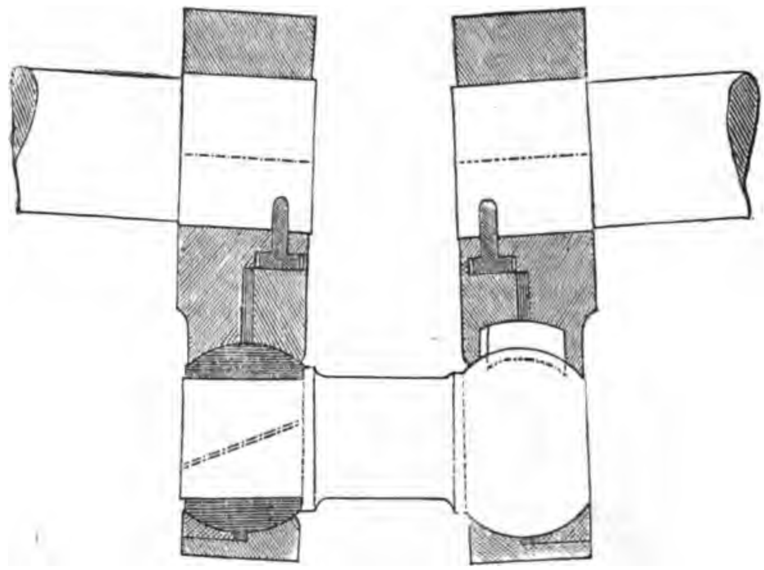
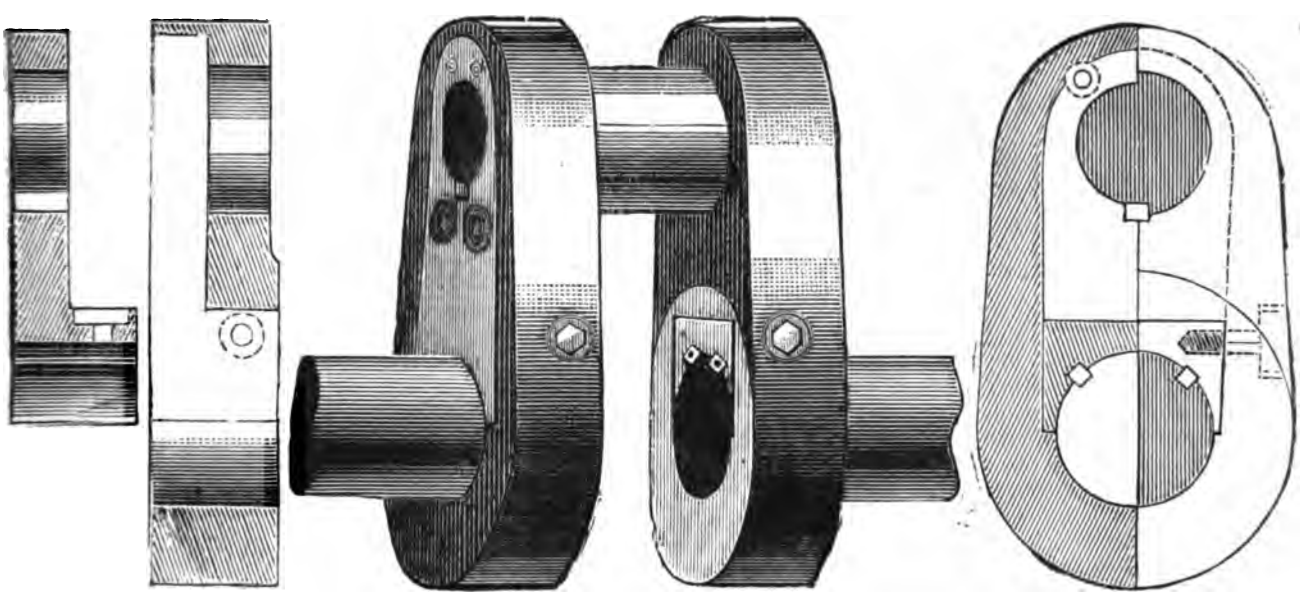


Fig. 1.

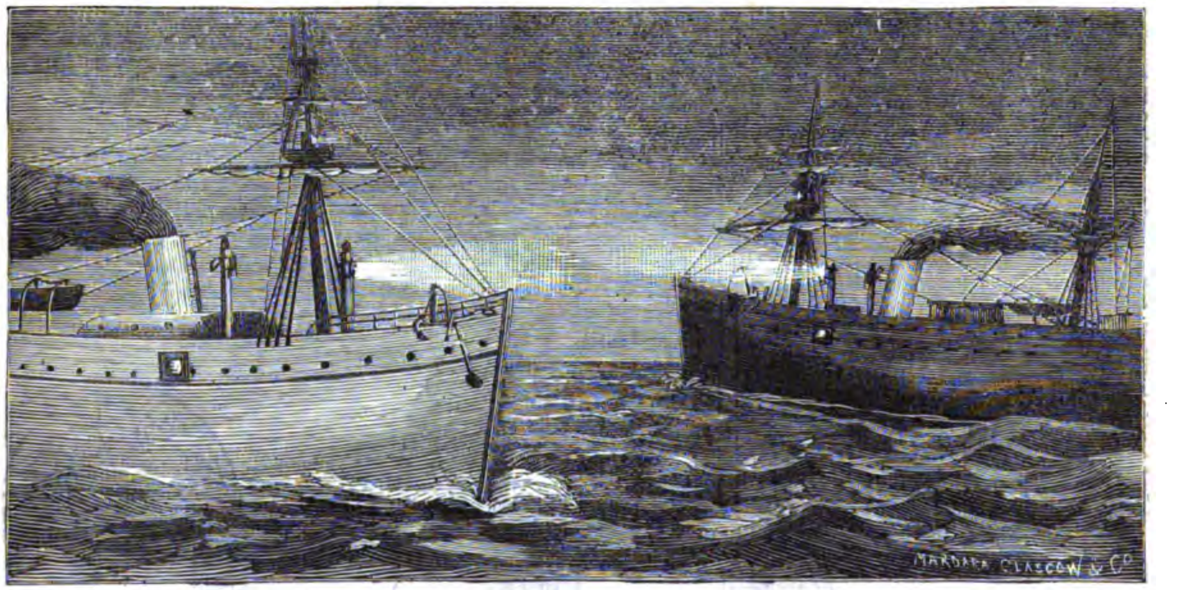


PATERSON'S PATENT BUILT-UP CRANK SHAFTS.—(See page 7.)

STAVER'S SYSTEM OF NIGHT AND DAY SHIP SIGNALS.

IN designing his system of visible signals, Captain Staver has aimed at placing in the hands of the commander of a vessel means whereby he can unmistakably convey to those in charge of an approaching vessel the movement he is making with his helm. It is a well-known fact that nearly 90 per cent. of all collisions are caused from the simple fact that the master of one vessel is unable to understand what the master of the other is doing with his helm; and Captain Staver is deserving of congratulations for having placed at the disposal of the officer in charge a sure and simple means whereby he can unfailingly indicate, either by night or day, to an approaching vessel the course on which he is steering.

The accompanying illustration shows two vessels passing each other on a port helm, and gives a general idea of the arrangement of the signals.



STAVER'S SYSTEM OF NIGHT AND DAY SHIP SIGNALS.

These consist essentially of two standards, erected one on each side of the bridge, and of a suitable height, having regard to the construction of the vessel and the position of her sails. Each standard has mounted on the top of it a light corresponding in colour with the side-light over which it is placed. In addition to the light, each standard also carries a semaphore arm, painted to correspond with the respective lights, and by these means provision is made for effective night or day signalling. In their normal position, that is when not in use, the lights are masked and the arms are down, the mask and arm of each standard being connected by links to a lever pivoted at the base of the standard.

If now a vessel is seen aproaching, the officer in charge gives his orders to the helmsman and draws down the lever of the standard corresponding to that order, and thus instantly and visibly conveys to the approaching vessel the course on which he is steering, the drawing down of the lever simultaneously unmasking the light and projecting the arm at right angles to the standard. The whole arrangement is exceedingly simple, and, unlike the system of signalling by blast, cannot possibly be misunderstood. We are pleased to see that Captain Staver, whose address is The Jerusalem, Cornhill, E.C., where models can be seen, has received flattering testimony of the value of his invention from many practical men who have seen it, Mr. Gray, of the Board of Trade, and Mr. Martell, of Lloyd's Registry, having, amongst others, spoken highly of it, while the inventor was awarded a bronze medal at the Liverpool Exhibition for his system.

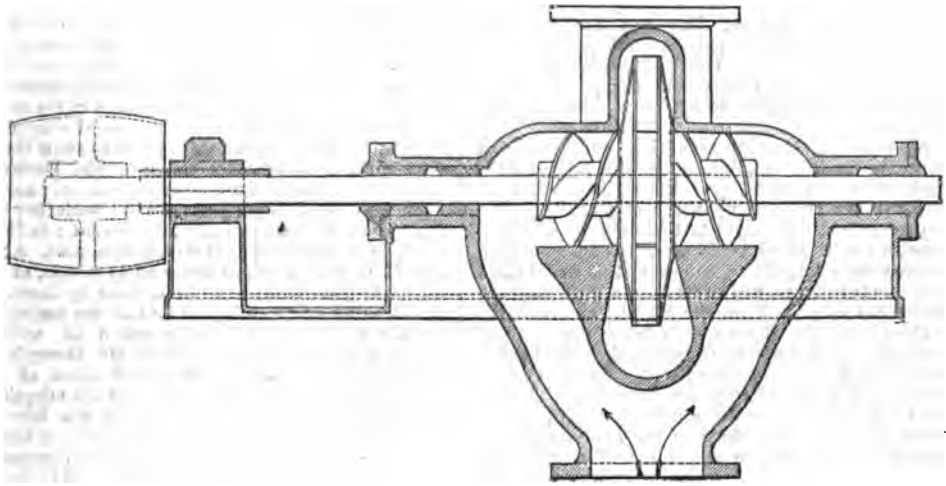
WADE'S PATENT CENTRIFUGAL PUMP.

WE have recently had occasion to inspect a new form of centrifugal pump patented by Mr. G. W. Wade, of Hornsea, near Hull, and which we have pleasure in herewith illustrating. This pump, as will be seen from the accompanying sectional elevation, differs from other centrifugal pumps in that it has mounted on the same spindle, and respectively on each side of the ordinary fan, a right and left handed helix, or screw, which are so proportioned as to be just a working fit within the recesses formed for their reception on either side of the fan.

The offices of these screws are threefold: First, they establish a more or less perfect vacuum, and so assist to draw the water to the fan, as is established from the fact that a "Wade" pump will start working when placed centre of spindle, 31 ft. above the level of the water to be pumped; second, they throw the water into the fan and so ease it of the duty of having to be its own drawer of water, and third, by establishing a rotary motion of the water before it reaches the fan, they allow of its being run at a much lower speed, and so avoid that churning action which is frequently found in centrifugal pumps. The high efficiency of the "Wade" pump is shown by the results of a trial made with a 6-in. pump. On a lift

of 12 ft., including 2 ft. head, this pump threw 532 gallons per minute when running at 504 revolutions per minute, and absorbing 4·35 I.H.P. This is equal to 18,000 feet lbs. per I.H.P., or an efficiency of 55 per cent.

These pumps are now in use by the engineer to the River Wear Commission, at Sunderland, at the Preston Dock, and at several other places, and wherever used have given the utmost satisfaction, a fact proved by the numerous letters Mr. Wade has submitted to our inspection, in all of which the pump is spoken of in the most flattering terms.



WADE'S PATENT CENTRIFUGAL PUMP.

THE LATE WILLIAM DENNY, SHIPBUILDER, DUMBARTON.

THE announcement of the death of Mr. William Denny, managing partner of the well-known shipbuilding firm of William Denny & Brothers, Dumbarton, was made in the Glasgow papers of the 19th ult., and was received with the greatest surprise and regret. The sad event took place on the previous day at Buenos Ayres, South America, where Mr. Denny had gone about eight months ago. In the absence of any intelligence as to the specific cause of death, it was at first thought that he had fallen a victim to the cholera, known to be prevalent in that part of the world. Later intelligence, however, shows that through over-pressure of the brain, brought on by too assiduous attention to business while in an enfeebled state of health, his mind became unhinged, with the result that he terminated life with his own hand.

About a year ago he suffered severely from an attack of typhoid fever, and it was mainly to recruit his health, which had never been satisfactory since that illness, that he undertook the journey to the River Plate. He was of such an ardent temperament that he did not spare himself, as he should have done, in discharging the business with which he was entrusted—attending to the organization of La Plateuse Flotilla Company—a shipping concern in which his firm had a large interest. Both in Dumbarton and throughout the West of Scotland his decease is sincerely mourned, and much sympathy is felt for his widow and for his worthy parents—Mr. and Mrs. Peter Denny, Dumbarton.

He was universally admired and esteemed, and his death (at the early age of 39, at a time when he was doing most useful work and achieving distinction for himself and his native town) is regarded as a serious public loss.

The deceased was born at Dumbarton in 1847, and received his elementary education there. From thence he went to Edinburgh High School, where he remained till he was seventeen years of age. As a shipbuilder his education began at this early period, and for several years he wrought as a workman in the principal departments of the shipbuilding yard. In this way he obtained a practical knowledge of the construction of vessels in all its details; and it was owing to his having been a craftsman himself that he had always great sympathy for working men. At the early age of twenty-three he became a partner in the firm of Messrs. William Denny & Brothers, of which his father and deceased uncles were the founders, and shortly afterwards he joined the firm of Messrs. Denny & Co., engineers, a separate concern, but one in which the leading members of the Denny family were represented.

A few years afterwards, in consequence of his great skill and discretion, he was made the managing partner of the shipyard, so that till the period of his lamented death, the burden of conducting the affairs of one of the greatest Clyde shipbuilding establishments rested upon his shoulders. His name was closely associated with all the best work of the establishment, and to his talent, skill, and energy, many of the improvements that the firm have effected are due. Owing to his training at the bench, theoretically and practically, he had a masterly knowledge in principle and detail of every branch of the business. In everything connected with it he took a lively interest, and under his care and management every department was conducted with a method and system of the most exact and satisfactory nature. Perhaps the most noteworthy feature in this respect is the drawing staff, a department in the shipyard upon which Messrs. Denny place great importance, and in its maintenance expend a very large sum annually. It is beyond question the largest staff employed by any private shipbuilding firm in existence, and it includes many gentlemen who have brought to the work of the drawing office all the advantages of a University training, while the larger number are students or past students of the Naval Architecture and Science Classes, held under the auspices of the Government Science and Art Department. The drawing staff proper is divided into two general sections, spoken of severally as the "technical" and the "scientific" sections, each having its own particular line of work defined for it. Co-related to this department, but with a special staff of workers, there is the experimental tank department, instituted by the late Mr. Denny for conducting speed experiments with ships' models. This notable section of Messrs. Denny's works, it may be explained, is on a scale of great completeness, and the work undertaken in it follows largely on the lines laid down by the late Dr. Wm. Froude, whose work at the Experimental Tank at Torquay (still carried on, but at Portsmouth, by Dr. Froude's son, Mr. R. E. Froude) has been of such signal service to the Admiralty and to the Naval Architecture profession generally. From the above it will be seen that for expedition and thoroughness in all the work of ship design, and for the full record and digestion of their experience in practice the Messrs. Denny are more than ordinarily well equipped.

Through the spirited enterprise of the late Mr. Denny, as managing partner, he instituted about three-and-a-half years ago a most elaborate series of extensions and improvements in the shipyard, through which the works have been enlarged to more than double their previous dimensions, and correspondingly increased in working capability. They now occupy a total area of forty-three acres, over five acres of which are taken up with wet dock accommodation and as much as seven-and-a-half acres with workshops, sheds, and roofed spaces of various kinds.

The yard has a most advantageous and extensive frontage to the Leven, which, under the provisions of a Harbour Act recently obtained through the instrumentality of Mr. Denny and other Dumbarton gentlemen, has been greatly improved as regards width and deepening. The principal launching berths are eight in number, and range about the centre portion of the yard's length, and are capable of receiving vessels of dimensions and tonnage such as the present race for big ships has not even approached.

Beside these principal berths there are spaces near the south end of the yard where light draughts, paddle steamers, and the smaller class of screw vessels are constructed and launched, or taken to pieces and shipped abroad. All the work of construction, fitting out and putting machinery on board ship, is accomplished within the yard gates. Contributing to this result are two tidal docks—one, recently formed, of over four acres in extent, and another of over an acre. In connection with the new dock, powerful sheer-legs have been erected by Messrs. Day and Summers, of Southampton, capable of lifting the enormous weight of 100 tons. The engines and boilers for Messrs. Denny Brothers' ships are invariably supplied by Messrs. Denny and Company, whose large works, greatly extended within recent years, are situated further up the Leven.

While most of the late Mr. Denny's time and skill was necessarily spent in the work of administrating this large establishment, yet much of his energy and special talents were devoted to matters which had a wide bearing upon the shipbuilding profession. So early as 1874 he distinguished himself by adopting the system of measured mile speed trials of merchant steamers, which had previously been introduced in one or two naval ships by the Admiralty. This consists, as is well known, in trying the vessel at various speeds ranging from the highest to about the lowest to which she is capable, these speeds being the mean of two runs, one run with the tide and one against, the object being to eliminate the tide's influence from the result. The data thus obtained is recorded in a series of curves representing the chief properties of ship, engines, and propeller, *e.g.* "speed and power," "revolutions," and "slip," which show to the eye more easily than bare figures the whole course and value of a steamer's performances.

From the accumulation of trial results thus graphically recorded, the designer of new ships can proceed to estimate with greater assurance of attaining satisfactory results than by employing the older methods. Embodying in 1875 the results of some such trials in a paper entitled, "The Difficulties of Speed Calculations," he was awarded a gold medal by the Institute of Engineers and Shipbuilders of Scotland, before whom it was read. All the vessels turned out by his firm since that time have been subjected to similar trials, and he has read several other papers on the subject before the Institute of Naval Architects. Combined with investigations of this kind are those of speed experiments with ship's models, both forming pet studies of Mr. Denny. For the carrying on of the latter feature he had the experimental tank erected to which reference has already been made.

Such work and the communicating of results obtained from it to the various scientific societies with which he was connected had justly earned for Mr. Denny a special reputation as an investigator. Aided by the large staff at his command, he also interested himself deeply in, and rendered notable service to the question of the stability of merchant vessels. Two years ago, when professional attention was forcibly directed to this subject by the *Daphne* and *Austral* disasters, and the increasing number of losses at sea, he devoted his talents, and those of the staff under him, to the elucidation of the problem of stability, and communicated the results in one or more papers to the Institution of Naval Architects. Since that time it has been the custom of his firm to furnish the captain and owners of each vessel turned out from Leven Shipyard with a bound printed volume, made up of letterpress and diagrams, of the technical characteristics of the new vessel. The book comprises information regarding stability, trim, speed, carrying capacity, strength, &c., and, it is understood, is highly valued by the owners and ship captains into whose hands they have been put. It is found a material help to them in managing a vessel of whose "points" they would otherwise be quite ignorant of, for a time, at first. Owing to Mr. Denny's special knowledge on these and kindred subjects, he was appointed a member of the Load Line Committee, which some six months ago tendered its report and gave such satisfaction. Mr. Denny tendered valuable evidence and otherwise served with great acceptance on the committee.

The name of the deceased gentleman was closely identified with the subject of the suitability of mild steel for shipbuilding, and not a little of the rapidity with which that material won its way into favour is due to the spirited manner in which Mr. Denny advocated its adoption, and backed up his opinion by using it whenever possible in the ships built by his firm. One of the first, if not quite the first vessel of any considerable size, built of mild steel, was the *Buenos Ayrean*, ordered by Messrs. J. & A. Allan, of the Allan Line, and turned out from Leven Shipyard in 1879. To satisfy all concerned with the construction of this vessel, Mr. Denny started a testing department in the shipyard, and procured at considerable cost a testing machine, similar to the one then employed by Professor Kennedy, at University College. Many hundreds of tests were made with the steel sent into the yard, and the results of these, as well as the practical experience derived from working the material into the structure of the ship, were embodied in a paper on "Steel in the Shipbuilding Yard," read before the Institution of Naval Architects in 1880. As a result of Mr. Denny's advocacy, the practice insisted upon by Lloyd's of testing the material in the shipyards was discontinued, and arrangements come to whereby it could be tested before leaving the steel works. This was a clear economical advantage, for the new material, handicapped as it was already by greater cost in the production than in the case of its established rival, iron. The development of steel shipbuilding is too well known to need enlarging upon; but to show that the share in this development effected by the late Mr. Denny, or the firm he represented, has been considerable, it is only necessary to state that in the year 1879, 57 per cent. of the vessels they built were of steel; in 1880, 76 per cent.; in 1881, 80 per cent.; in 1882, 72 per cent.; in 1883, 68 per cent.; in 1884-5-6, 100 per cent. Altogether, since the advent of mild steel, as many as 83 vessels, of a total tonnage of about 118,000 tons, have been built by them, and in their construction as much as 50,000 tons of the material have been used. In the matter of the introduction of water-ballast cellular bottoms into merchant steamers, Mr. Denny's name also stands connected. The important consideration of tonnage measurement for a time stood in the way of its adoption; but after the victory Messrs. Denny gained over the Board of Trade—who insisted upon measuring into the tonnage of vessels so constructed half of the cellular space—the system spread apace. Messrs. Denny maintained that the only equitable line of measurement was the top of the ceiling on the inner bottom, and not, as the Board of Trade maintained, to the imaginary line of the ordinary floor. All the vessels which have been built by Messrs. Denny since that time, in which water-ballast was desirable, have had their bottoms constructed on the cellular principle, and other firms have followed suit.

Mr. Denny was a Fellow of the Royal Society of Edinburgh, a Member of Council of the Institution of Naval Architects, a Member of the Institution of Civil Engineers, a Member of the Institution of Mechanical Engineers, a Member of the Iron and Steel Institute, and a Member of Council of the Institution of Engineers and Shipbuilders in Scotland. In all of these societies he was well known, and in more than one of them his presence and influence will be missed.

The deceased gentleman took a deep interest in all that concerned the material well-being of the people of his native town. He was connected with almost all the institutions in the burgh of Dumbarton—educational, benevolent, and social—took a warm interest in them, and contributed ungrudingly to their support. In a sense he was the chief townsman of Dumbarton, and his death is regarded as nothing short of an irreparable public loss.

The owners of the s.s. *Haitan*, whose trial trip is reported, expressed their satisfaction with the ship, by giving through Messrs. Raylton, Dixon and Co., her builders, the sum of £27 10s. for distribution among the local charities as follows:—Cottage Hospital £10; North Riding Infirmary £10; St John's Ambulance Dockyard Class £4; Hull Sailors Orphans' Society £3 10s.

Shipbuilding at Seacombe.—At the yard recently opened by Messrs. J. F. Waddington and Co. there have been already three launches this year which shows there is an amount of activity displayed by this firm which augurs well for them. The steam launches mentioned have proved highly satisfactory, and it is noteworthy that they have come up to within the guaranteed speed at once without requiring to make alterations. They have just secured the order for a twin screw ferry steamer for the new ferry station on the Mersey; she will have a saloon deck and promenade deck, smoke cabin forward, and will be a handsome vessel.

DESCRIPTION OF A PORTABLE HYDRAULIC DRILLING MACHINE.*

By M. MARC BERRIER-FONTAINE, of Toulon.

THE small Portable Hydraulic Drilling Machines, shown in the accompanying diagrams, Figs. 1 to 4, are capable of drilling in their place and after erection nearly all the holes required for rivets, bolts, &c., in all kinds of iron or steel structures—such as ships, bridges, girders and boilers—wherever hydraulic pressure is available for working them. With these portable machines the parts can be drilled in their places as rapidly as they would be drilled by stationary drilling machines in the shops, the shifting of the portable machine from one hole to another being as easily accomplished as the shifting of a piece of work of equal weight under a stationary machine. In this way holes are drilled in place even more readily than the same holes could be severally drilled by a stationary machine in the shops; because by drilling in place, a single operation serves to drill through all the superposed thicknesses without stopping the drill; whereas when the pieces are separate, as in the shop, as many separate drilling operations are required as there are pieces, and the work consequently involves much more labour and time. Besides effecting considerable saving, this mode of drilling in place presents also the great advantage of ensuring that the holes are quite true through all the superposed thicknesses, without having been previously set out on each separate piece; and thus all such preparatory work is dispensed with, as well as the labour and time necessary for carrying the separate pieces, first to the drilling shop from the places where they have been marked, and then back again to their places after they have been drilled.

The size and weight of the portable hydraulic drills, by which these advantages are secured, are so small that these machines can be used for drilling nearly all the holes required in the most complicated structures, even in the most confined spaces; and they can be used for driving the drills either directly or through flexible shafts or other intermediate apparatus. In the accompanying diagrams is shown three times full size one of the two sizes of portable hydraulic drilling machines which have hitherto been made by the author for use in Toulon Dockyard. Other sizes for different powers could be easily designed, as they might be required.

The drill shown in Figs. 1 to 4 is of 1 H.P., and drills holes up to 2 in. diameter, either directly, as in Figs. 1 and 2, or through a flexible shaft, as in Figs. 3 and 4, the driving shaft making 90 revolutions per minute; the sockets of the drill-holder and of the flexible shaft No. 8, which can be fixed to it, are identical with those of a No. 4 Morse twist drill, and consequently fit the conical shanks of the twist drills from 1$\frac{3}{8}$ to 2 in. diameter. The smaller machine is of ½ H.P., and drills holes up to 1¼ in. diameter, either directly or through a flexible shaft, the driving shaft making 150 revolutions per minute; the sockets of the drill-holder, and of the flexible shaft No. 6, which can be used with it, are identical with those of a No. 3 Morse twist drill, and therefore fit the conical shanks of the twist drills from $\frac{15}{16}$ to 1¼ in. diameter.

Each drilling machine is composed of two parts:—

Firstly, a small hydraulic motor M, driven by water pressure supplied from a main through flexible or jointed pipes, like those commonly used for portable hydraulic riveters. The discharge water is led away through india-rubber tubing. The motors shown in the drawings are Brotherhood's three-cylinder engines, but other hydraulic motors could be applied, provided they are sufficiently light and compact.

Secondly, a drill-holder, consisting of a small frame F of C shape, in which are arranged the bearings of the driving shaft A from the motor, and of the hollow drill spindle D at right angles to it. On the motor shaft A is keyed a bevil wheel B, gearing with a bevil pinion P on the drill spindle D. At one end of the drill spindle is a socket S for holding the drill; and the other end is threaded internally for receiving the setting-up screw T, which is turned by the hand-wheel W, either to give the feed whilst drilling or to withdraw the drill when the hole is finished. A longitudinal slot L for the key of the bevil pinion P allows the drill spindle to slide through the pinion, while the latter is kept in place by an annular recess R. Beyond the hand-wheel W, the screw T terminates in a point J, which can be pressed against a cross-piece or frame, such as is used for drilling with a ratchet-brace. The central part of the frame F is bolted to the flange of the motor M, and thus forms a long bearing for the shaft A; and small closed lubricators ensure the bearing being properly oiled, in whatever position the drill may be held. In the base G of the motor are slotted holes, for fixing it by bolts put into holes in the structure, thus ensuring perfect steadiness in drilling. A ring with two handles H is placed at the centre of gravity, so that a workman can easily carry the drill from place to place.

When the drill is driven direct the drill spindle D is geared to run at the same speed as the driving shaft A of the motor, by making the two bevil wheels B and P of equal diameter, as shown in Figs. 1 and 2. But when a flexible shaft is used for conveying the power from the motor to the drill, the flexible shaft itself must be made to run five times as fast as the motor shaft and the drill; it is therefore geared both to the driving shaft A at one end and again to the drill spindle at the other end by bevil wheels in the proportion of five to one, as shown in Figs. 3 and 4. The flexible shaft is fixed at one end to the pinion P by a clutch K similar to that used for attaching it to a driving pulley; and the other end similarly drives the drill. In this case the drill spindle D has no longitudinal movement, the feed of the drill being given at the other end of the flexible shaft by means of the screw belonging to it.

Owing to the great importance of reducing to a minimum the weight of these portable machines, so that they may be shifted as easily as possible from hole to hole, they are made entirely of steel and phosphor-bronze. By this means the weight of the whole machine complete, including the two stop-valves for inlet and outlet does not exceed 105 lbs. for the 1 H.P. drill, and 62 lbs. for the ½ H.P. Trials made for a lengthened period have proved that on board a large armour-clad man-of-war, built on the cellular system, and consequently of very complicated design, the number of holes drilled in place by these small hydraulic machines is at least 25 per cent. greater than the number of similar holes that can be drilled in the same time by stationary machines in the shops; and is at least six or seven times greater than the number of similar holes that can be drilled in place by ratchet-braces.

The first two of these drills, which have now been in regular use for nearly two years in the Mourillon yard, at Toulon, have been found so advantageous in working, alike in quality and rapidity and economy of work, that fifteen more have already been ordered for the same yard, of which five will be of 1 H.P. and ten of ½ H.P.

* *Paper Read before the Institution of Mechanical Engineers.*

TRIAL OF H.M.S. "CAMPERDOWN."

THE new barbette armour-clad *Camperdown* completed her official full-power runs, under natural and forced draught, at Portsmouth last month. Her keel was laid down on the 18th of December, 1882, and she was launched on the 22nd of November, 1885, having thus taken three years to build. She belongs to the "Admiral" class of battle ships, which comprise the *Camperdown*, *Collingwood*, *Benbow*, *Anson*, *Howe*, and *Rodney*, the whole of which, with the exception of the *Anson* have made successful trials of their machinery. She measures 330 ft. between perpendiculars, 68 ft. 6 in. in extreme breadth, and 26 ft. 2 in. in depth of hold, her mean draught being 26 ft. 9 in., and her displacement 10,000 tons. Up to the present time she is the longest armour-clad built at Portsmouth, being 5 ft. longer than the *Colossus*, and 10 ft. longer than the *Inflexible*; and while the differences in her design and armour have enabled the constructors to increase her bulk without increasing her displacement beyond that of the *Dreadnought*, she will carry armament of twice the weight of that of the older battle ship. She is protected amidships by a water-line belt 150 ft. long, 18 in. thick, 7 ft. 6 in. deep, of which 2 ft. 6 in. are intended to be above the water when fully equipped; the whole forming, with athwartship bulkheads at the ends, a central citadel for the protection of the vital parts of the ship. The *Camperdown* will carry four 13½ in. 67-ton breechloaders in two barbettes placed forward and aft, and covered by 14 in. sloping compound armour; and six 6 in. 5-ton breechloaders under the spar deck. This armament, which is less powerful than that of the *Benbow* (which is to be provided with 110-ton guns) and more powerful than that of the *Collingwood* (which carries 44-ton guns), is the same as the armaments of the *Anson*, *Howe*, and *Rodney*. The *Camperdown* will be manned by a complement of 430 officers and men.

The engines and machinery have been manufactured and fitted on board by Messrs. Maudslay, Sons, and Field, of London. They consist of two sets of three cylinder compound inverted engines, having two low-pressure cylinders placed together. In general design and arrangement they are similar to those fitted by

the same firm in the sister ship *Benbow*, cast steel being used throughout to a very great extent. Each set of engines has one high-pressure cylinder 52 in. in diameter, and two low-pressure cylinders 74 in. in diameter, the stroke being 3 ft. 9 in. The cylinder linings are of Whitworth's fluid compressed steel. The crank shafts, which are made of steel and hollow, are interchangeable, the cranks being placed at an angle of 120 degrees with each other, while centrifugal lubricators are fitted to the crank pins. The surface condensers, together with the air pumps and hot-wells, are made of gun-metal, and the condensers are constructed so as to be worked as common condensers if required. The condensers contain 11,550 brass tubes, having an external diameter of ¾ in., with a cooling surface of 17,000 square ft. The cold water is circulated through the main condensers by centrifugal pumps, each driven by a pair of inverted engines having a stroke of 15 in., the diameter of the cylinders being 12 in., and that of the fans 4 ft. These pumps are also arranged for pumping water out of the ship in case of accident, provision being made for a direct suction of the water from the bilge instead of its having to pass through the condensers. Each set of engines has two air pumps, 30 in. in diameter, worked by wrought iron beams by means of levers from the cylinder crossheads. The bilge pumps are also worked by these beams. The boilers are twelve in number, and are placed in four separate compartments forward of the engine rooms. The boilers are 12 ft. 4 in. wide, 14 ft. 1 in. high, and 9 ft. 11 in. long, having in all 36 furnaces, 3 ft. 2 in. in diameter and 7 ft. long. They are fitted with 3,432 tubes, 2¼ in. in diameter and 7 ft. long, and possess a collective area of fire-grate of 800 square ft. The tube plates and combustion chambers are made of the best Yorkshire iron and the shells of Siemens-Martin steel. The safety valves are of the latest approved type, with spiral springs of square steel, and loaded to 90 lb. per square inch. The stop valves are placed horizontally and are self-acting. As is now customary, the stokeholds are arranged for working with forced draught when the engines are required to exert their full power, and air wells are fitted at all the exits. For the purpose of maintaining the air pressure eight fans, 5 ft. in diameter, are provided, worked by small horizontal engines. Two are located in each boiler room, while means are provided for shutting each one entirely off to prevent the escape of air should the engine break down. Escape ladders and doors have been fitted to the boiler rooms where possible, the doors flying open immediately they are released, so as to give those in the stokehold a chance of making good their escape should an accident happen when the boiler room is closed up and under forced draught. In addition to the auxiliary engines already mentioned, there are on board four fan engines with fans 4 ft. 6 in. in diameter, for ventilating the magazines and other parts of the vessel below the steel protective deck; two powerful horizontal fire engines which can be worked coupled and separately; two engines of Admiralty pattern placed in the engine-room, and four smaller ones placed in the boiler rooms for feeding the boilers; two bilge engines, two turning engines, four ash-hoisting engines, besides several others. The whole of these auxiliary engines exhaust into a separate condenser placed in the starboard engine-room, the condensing water being circulated through it by means of a small centrifugal pump. Four of Friedmann's patent ejectors are fitted for the purpose of clearing the bunkers of water in the event of their being flooded; and there is also a very elaborate system of drainpipes and steam traps to prevent the accumulation of water in any of the steam or exhaust pipes. The propellers are 16 ft. in diameter and 2 ft. 8½ in. in length, with a mean pitch of 19 ft. 6 in., while their bearing area is 76 square ft. The contract power is 7,500 horses with natural draught, and 9,500 horses when working with closed stokeholds and forced draught.

The six hours' trial under natural draught was made on March 14th, on a smooth sea, and with very gratifying results. The ship was under the command of Captain Tracey, of the Portsmouth Steam Reserve; the trial was conducted by the Hon. George Duncan and Mr. Warrener on the part of the contractors; while Mr. Alton, Chief Inspector of Machinery, Mr. Corner, of the Dockyard Steam Department, and Chief Engineer Wootten, attended on behalf of the naval authorities. Among others present were M. Zecknechie, Naval Attaché for the Austro-Hungarian Government, and a representative of the Italian Government. The trim of the ship had been slightly modified since the preliminary trial, but without making any difference in her mean draught. She had been brought down a little at the bows and lightened at the stern, so that her immersion was 22 ft. 3 in. forward and 24 ft. 5 in. aft, or 3 ft. 5 in. less than her designed load draught. Even thus light, and running over a still sea, the vessel threw up a wave with her cutwater as high as her hawseholes, but with a short profile. The machinery worked without giving any trouble to anyone concerned from first to last, the bearings remaining cool throughout. With one exception every half-hourly observation showed that the engines were indicating more than 8,000 horses, and, consequently, in excess of the contract. The mean of the six hours' steaming gave a collective power of 8,605·95, while the ship, as tested by four runs on the measured mile at an early part of the trial, and when the engines were not exerting their greatest power, realized an average speed of 16·3 knots. The reading of the patent log showed that the ship had travelled 112½ knots during the six hours and a half, which gave her a speed of 17·2 knots an hour. The consumption of fuel during the trial was 2·11 lb. per horse per hour, which, under the conditions mentioned, would enable the *Camperdown* to steam over 2,000 knots.

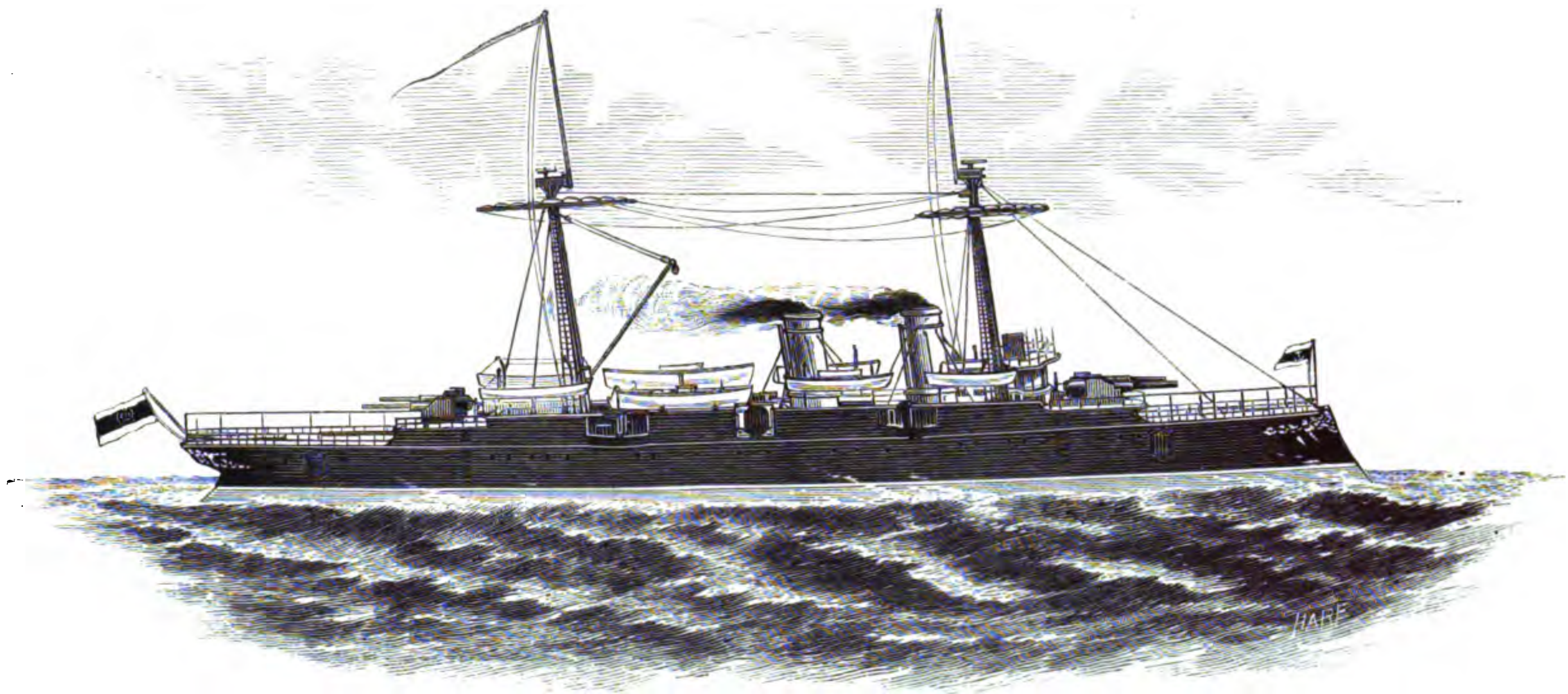
The trial under forced draught was made on March 16th with even more satisfactory results. The number of visitors was very great; among them were Mr. R. Sennett, engineer-in-chief of the Navy, Mr. Walter Maudslay, Mr. Sells, Mr. Froud, and Mr. Brunell. The sea was rougher than on the previous trial, the wind blowing from the north-east with a force of from 3 to 4. The draught of the ship was again changed. The immersion was 22 ft. 4½ in. forward and 24 ft. 4½ in. aft, the sinkage being parallel to the load-line. Previous to beginning the engine trial the ship was tested as to her steering-power, with the following results:—Circling to starboard, the tiller was put over from amidships to 34 deg. of helm in 15 seconds, the half-circle was completed in 2 min. 10 sec., and the full circle in 4 min. 53 sec., the diameter of the circle being 630 yards. Circling to port the tiller was put over in 11 seconds, the half-circle was performed in 2 min. 20 sec., and the full circle in 4 min. 42 sec., the diameter being in this instance 650 yards. The vessel was perfectly obedient to the helm, no leverage being necessary to keep her in a straight line. The four hours' trial under forced draught, with two inches of water pressure in the stokeholds, was then commenced, the ship being taken long runs to sea beyond the Nab to obviate the necessity of turning and so throwing increased strains upon the engines. The following table gives the result of the half-hourly observations:—

Revolutions.		Mean Pressures.				Collective Horse Power.
		Starboard.		Port.		
S.	P.	H.	L.	H.	L.	
101	101½	38·5	19·65	43·4	19·0	11,720·16
100	100	34·0	21·55	38·7	19·6	11,579·88
99	99½	35·5	20·6	33·4	21·3	11,441·29
100½	101½	41·2	18·85	37·2	21·0	11,723·77
103	104	41·1	19·9	34·7	19·9	11,857·59
103	103	40·0	18·9	36·2	21·8	11,985·21
102¾	103	38·8	19·75	36·2	20·6	11,839·59
101	102	29·5	20·3	36·0	20·45	11,779·42

No incident of any kind occurred during the four hours to detract from the uniform success of the trial. Two runs were afterwards made upon the measured mile, the mean showing a speed of 17·144 knots, which was in substantial agreement with the patent log, which registered a travel of 68¾ knots during the four hours and an average speed of 17·2 knots. The following is a summary in juxtaposition of the mean results obtained under natural and forced draught:—

——	Natural Draught.	Forced Draught.
Steam in boilers	83·31 lb.	88·00 lb.
Vacuum, starboard	28·33 lb.	26·93 lb.
Vacuum, port	28·29 lb.	27·43 lb.
Revolutions, starboard	95·41 lb.	101·40 lb.
Revolutions, port	95·38 lb.	101·85 lb.
Mean Pressures:—		
Starboard, high	47·55 lb.	38·58 lb.
Starboard, low	11·87 lb.	19·23 lb.
Port, high	46·75 lb.	36·97 lb.
Port, low	11·87 lb.	20·47 lb.
Indicated horse power:—		
Starboard, high	2,168·86	1,890·48
Starboard, low	2,068·63	3,955·60
Port, high	2,153·28	1,817·56
Port, low	2,215·17	4,077·21
Collective I.H.P.	8,605·95	11,740·86
Speed of ship, knots	16·305	17·144
Consumption per hour	2·11 lb.	3·26 lb.

So far the *Camperdown* slightly heads the record of the achievements of ships of the "Admiral" class. During the day the United Telephone Company, of London, experimented with



THE REINA REGENTÉ.

NEW ARMOURED CRUISER FOR THE SPANISH NAVY. BUILT BY MESSRS. J. & G. THOMSON, CLYDEBANK.

(For Description see page 7.)

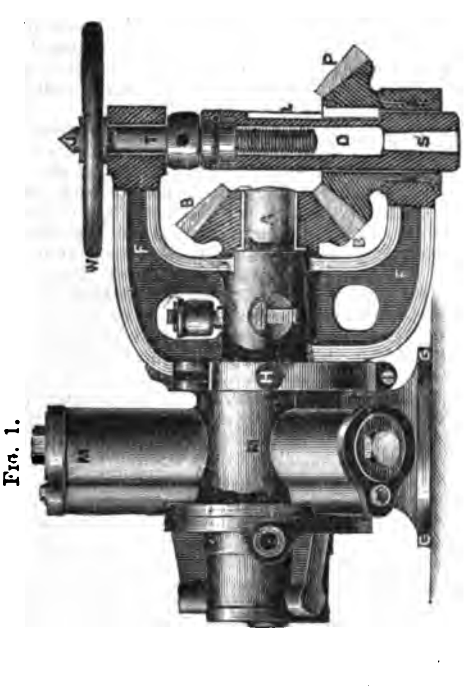


Fig. 1.

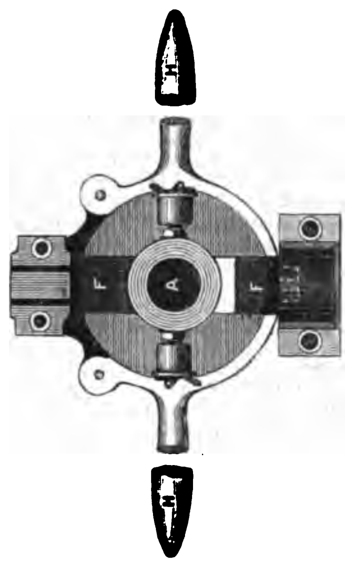


Fig. 2.

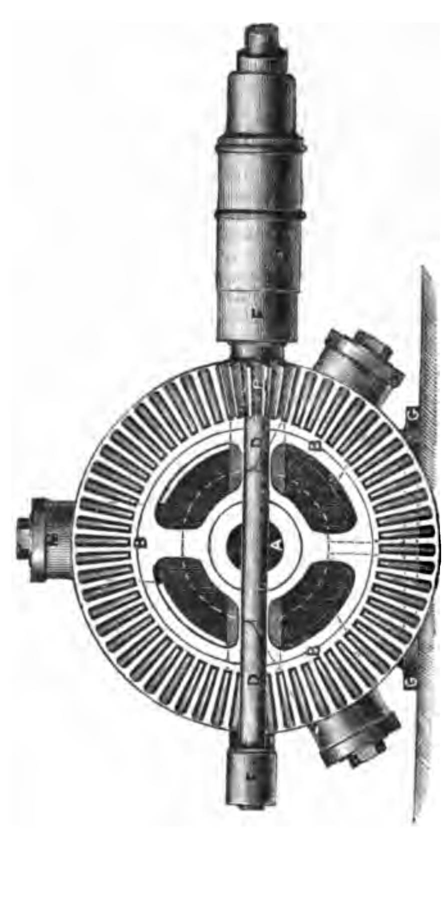


Fig. 3.

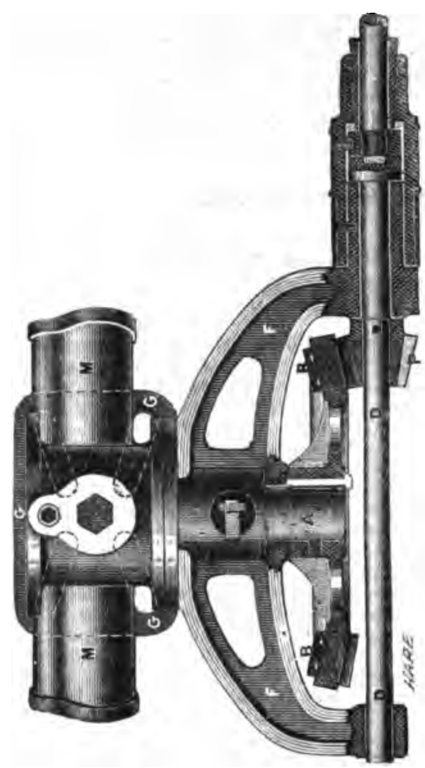


Fig. 4.

PORTABLE HYDRAULIC DRILLING MACHINE. (For Description see page 13).

an instrument for communicating between the bridge and the engine-room. The ordinary voice-pipe is impracticable in consequence of the noise produced by the machinery, and a committee has been appointed to consider how the difficulty can be surmounted. The telephonic instrument employed enabled the orders to be heard distinctly while the engines were working at their greatest power, and was favourably received by the officers on board.

LAUNCH OF A CRUISER ("FILIPINAS") FOR THE SPANISH GOVERNMENT.

On February 5th occurred one of the most important events that have marked the history of the Hong Kong and Whampoa Dock Company. They have been able to build and launch a steel cruiser for the Spanish Government. It may be remembered that when the Germans took possession of the Caroline Islands and planted their flag there, that proceeding caused the greatest excitement and indignation in Spain, and still more so in the Spanish colony of Manila. It called forth all the loyalty and public spirit of the colonists, and, headed by their Archbishop, a subscription was started, and the people enthusiastically responded to the call so readily that in a short time the Bishop of Manila arranged a contract for the construction of the vessel. A contract was entered into with the Hong Kong and Whampoa Dock Company to build the hull and engines for 120,000 dollars, thereby giving them an opportunity of putting in some degree to the test their new appliances and latest improvements, and the powers of their staff.

The *Filipinas* is built of mild steel throughout, and has been constructed on the lines of the *Scout* class of cruisers in the British Navy which have recently attracted so much attention. She has twin-screws and a powerful ram. She will be schooner-rigged, with two steel masts, and she carries two pairs of compound surface condensing engines, the engines and boilers being protected by the coal in the bunkers, which will form a very efficient armour. The principal dimensions of the vessel are: Length over all, 186 ft. 6 in.; 23 ft. 6 in. beam; 18 ft. 6 in. moulded depth; and a draught, when in full working trim, of 10 ft. The engines are of 650 I.H.P., the cylinders being 15 in. and 30 in. in diameter respectively, and with a stroke of 18 in. The guaranteed maximum speed of the vessel is 12 knots, and it is anticipated that she will exceed her contract speed. Two steel boilers of 8 ft. 9 in. and 9 ft. 6 in. diameter, built to sustain a working pressure of 120 lbs. to the square inch, supply the steam, and each of these will be heated by six furnaces. Abaft the engine-room, on the lower deck, is the magazine, and the greater part of the rest of the ship is occupied by accommodation for the captain and crew, store rooms, &c. The captain's and officers' cabins are on the 'tween decks. The vessel is divided into six watertight compartments, the first bulkhead being at the fore peak, one on either side of the engine room, and one abaft it. The engine room bulkheads are fitted with watertight doors, but the others are without any opening. The vessel is to be fitted throughout with the electric light, and pipes are laid all over her, so that any compartment may be readily flooded in case of a fire. She will be fitted with all the latest and most improved appliances, boilers for supplying steam for working the pumps and the electric light. The work of the Dock Company does not include the armament of the vessel; this will be provided by the Manila authorities, and it is anticipated that the Dock Company will complete their work in about six weeks. The time fixed for this fulfilment was the end of March, so it is expected it will be done well within the time. The vessel will carry five boats, one of which will be a steam pinnace. The armament of the vessel will consist of three steel guns of fifteen centimbre calibre, and six machine guns. One of the larger guns will be mounted forward as a bow chaser, and will have a range of half a circle, and the other two will be mounted on sponsons amidships, the bulwarks being lowered to fire them. The Nordenfeldts will be fitted in the tops and on the bridge. The ram projects 4 ft. from the line of the stem, being sharply pointed, and it is so constructed that when the vessel draws her full draught she will give but little indication of possessing it. The vessel is to be commanded by Captain Angel Lopez, of the Spanish Navy, who is now acting as his country's consul at this port.

LAUNCH OF H.M. BELTED CRUISER "GALATEA."

On March 10th there was launched from the shipbuilding yard of Messrs. Robert Napier and Sons, at Govan, a belted cruiser named *Galatea*, built by them for the British Government. This vessel is one of five similar ships built for the Navy by private firms in Britain. Two of them (the *Australia* and *Galatea*) have been built by Messrs. Napier; two (the *Orlando* and *Undaunted*) by Palmer's Shipbuilding Company (Limited), Jarrow; and the fifth by the Earle Shipbuilding Company, Hull. All the vessels have now been launched, and are being speedily completed, and when commissioned will form a most valuable addition to the British Navy. As full descriptions of this new type of warship have appeared in our columns, and as all the vessels are alike, it is only necessary now to mention the leading features. The *Galatea* is 300 ft. long between perpendiculars, 56 ft. in extreme breadth, and 37 ft. deep moulded. The draught of water under ordinary circumstances will be 19 ft., and at this draught the displacement will be 5,000 tons. This may be at times increased to 6,000 tons, when a full supply of coal is shipped. When in the normal fighting condition, with guns, ammunition, stores, and coal, and everything on board included in the 5,000 tons displacement, we understand the Admiralty expect a speed of 18 knots per hour; but when the trials are made on the Clyde, the ship being then without guns, ammunition, stores, or a full quantity of coal, the speed may reach 19 knots. The engines to be fitted on board, and which have been designed by the Messrs. Napier, are of the triple-expansion type, working twin-screws, and will indicate 8,500 H.P., the working pressure being 130 lbs. The Admiralty authorities proposed to have compound engines of 7,500 H.P., but on the representations of Messrs. Napier it was decided to make the engines of the triple-expansion type in all the five vessels, Messrs. Napier undertaking to develop 8,500 H.P. in their two ships without taking up any more room in the ship, or increasing the collective weight of the machinery and coal. The result will be to increase the speed by about a knot per hour, whilst less coal will be consumed. The boilers are of the double-ended multitubular type, and have corrugated flues. The armament will consist of two very long range 9½-in. Armstrong guns, ten 6 in. guns of the same class, all mounted on central pivot Vavasseur mountings, eight 6-pounders, and eight 3-pounders—quick-firing guns; also six torpedo impulse tubes. The two striking characteristics of this class of cruisers are, undoubtedly, their high rate of speed and great length of gun or range of fire. These qualities would generally enable them to overtake an enemy, or to avoid one altogether if too heavy metal for them; or using their great speed, they might keep the enemy within the range of their big guns, while they themselves were beyond the enemy's fire. Every safeguard has been adopted to shield them from the enemy's fire, and to prevent them from sinking. They are each divided into about 130 compartments or cells. The engines and steering-gear are all under the water-line, and are protected from *debris* or dropping fire by 2 in. thick steel decks extending the whole length of the ship. Messrs. Davies & Co., Limited, have fitted all the steering-gear, both steam and hand. The water-line of the ship is protected by an armour belt of 10 in. thick, steel faced, strongly supported by teak and steel backing, and capable of resisting a shot or shell from 10-in. guns.

The ceremony commenced about one o'clock. The weather was most unpropitious, a cold north-east wind blowing, accompanied by a continuous shower of blinding snow. A large covered-in platform was erected at the bow of the vessel to accommodate the guests. Amongst those present were Lord Charles Beresford, C.B., M.P., one of the Lords of the Admiralty; Mr. W. H. White, Director of Naval Construction; Messrs. T. Dodd, constructor, Admiralty; T. Coast, Admiralty overseer; D. Bennet, engineer inspector; W. T. H. Bills, chief engineer H.M.S. *Australia*; C. D. Stewart, chief engineer H.M.S. *Galatea;* Messrs. John Hamilton and James Hamilton, of Messrs. R. Napier and Sons; Sir William Thomson, Professor Jenkins, the University; Captain Luxmore and officers H.M.S. *Devastation*; Lieutenant-Commander Haggard and officers H.M.S. *Forester*; Lieutenant-Commander Napier and officers of the Naval Reserve; Captain Parry, training ship *Cumberland;* Captain Orlavsky, Imperial Russian Navy; Captain Poretchkin, Imperial Russian Navy, &c.

While the company were gathering, and during the ceremony, appropriate selections of music were played by the instrumental band of the training ship *Cumberland*, which was present by the kind permission of Captain Parry and officers of that ship. The

religious service appointed for the launch of Government vessels was conducted by the Rev. Dr. Macleod, parish minister, Govan, after which the vessel was prepared for launching. All preliminaries having been completed, and the tide sufficiently high, Miss May Kirk, on behalf of Lady Charles Beresford, released the vessel from her position on the ways, and as she started named her *Galatea*. The ship went into the water at a brisk pace, and when she made the final plunge the large crowd of spectators and artisans gave a hearty cheer, which was re-echoed by the men on board the ship. The band meanwhile played "Rule Britannia." The vessel was afterwards towed to the Finnieston Quay, where she will have her machinery and boilers placed on board.

At a luncheon which followed the launch Lord Beresford and Mr. W. H. White both made somewhat extended speeches, chiefly with reference to the constructional policy pursued by our Naval authorities.

INSTITUTION OF A MARINE ENGINEERS' UNION.

A GENERAL meeting of sea-going engineers who were favourable to the proposal for establishing a Union of Marine Engineers was held on Tuesday, March 1st, at Limehouse Town Hall, Mr. Russell Sinclair in the chair.

The Chairman, in opening the proceedings, said that it was unnecessary for him to adduce any arguments in favour of this movement, as their presence that evening was a most complete answer to the question whether such a Union was desired by engineers. He said that the Union might have been formed at once by the Interim Committee, but as they were self-appointed they considered it better to call a general meeting of those favourable to the movement, so that the appointment of a Committee being made by that meeting would give every one a fair chance of taking a prominent part in the management. It was already pretty well-known amongst those present what the constitution, operations, and objects of the Union would be, but as there might be one or two points upon which information would be desired, he had much pleasure in calling upon the Interim Secretary, who would give the necessary details, and answer any questions regarding them.

The Interim Secretary, having briefly related the circumstances attending the origin and progress of the movement, proceeded to give a sketch of the organization, operations, and advantages of the proposed Union, in which he very ably pointed out that the experience gained by the failures of previous attempts to improve the position of engineers had been laid under contribution, and while all their faults and defects had been carefully avoided, there had been introduced into the present scheme several new and valuable features which he was confident could not fail to secure a certain and permanent success. After replying satisfactorily to several questions as to minor details, he resumed his seat, when the following resolutions on being put to the meeting were carried unanimously.

(I.) That the only remedy for the present unsatisfactory condition of sea-going engineers' remuneration and general treatment is to form a Marine Engineer's Union, of such a character and with such an efficient organization as will prevent any further unjustifiable reduction of their pay or trespass upon their rights, and will use every lawful means for obtaining better remuneration, a higher standing, and more equitable treatment for sea-going engineers.

(II.) That the sea-going engineers present at this meeting shall and do hereby form themselves into a Marine Engineer's Union, to which none but sea-going engineers shall be admitted, which shall be devoted entirely to their interests, managed exclusively by themselves, and have for its objects the assertion and maintenance of their rights, redress for their wrongs, and improvement in their remuneration and treatment.

(III.) That the following members of this Union (here follows a list of 20 names) with power to add to their number, shall be and are hereby appointed a General Committee of Management of said Union, with full powers and instructions to draw up and adopt a suitable constitution and code of rules, elect and instal office-bearers, procure and occupy suitable premises in which to carry on its business, receive subscriptions, issue cards of membership, and do and perform all such other lawful acts and deeds as may in their opinion be necessary for the proper institution and management of said Union and the furtherance of its interests.

(IV.) That the General Committee shall be, and are hereby instructed, to make it a standing rule of the Union "That no office-bearer of the Union or any of its branches shall be entitled to, or be paid, any salary in respect of his office, or of any services rendered by him to the Union or its branches, in discharging the duties pertaining to said office.

The Chairman having declared that the Union was now formally constituted, said they ought to congratulate themselves upon the very harmonious and enthusiastic manner in which the proceedings had been carried on, and it now but remained for every member to make known to those engineers he met the nature and advantages of this Union, and he was certain that within a very short time they would be in such a position as to become a recognized power in the land, and be able to obtain for sea-going engineers at large those improvements and reforms which had been so long looked for, and were now so urgently required. He added that the Committee would meet at 91, Minories, and carry on their business there in the meantime, and as soon as the necessary arrangements were completed, notice would be sent to each member, so that he might take out his card of membership, and obtain a supply of copies of a circular which would set forth all necessary particulars regarding the Union, and were intended for distribution among sea-going engineers.

After a vote of thanks to the Chairman the meeting closed.

THE AMERICAN EXHIBITION, LONDON, 1887.

AN exhibition devoted exclusively to the arts, inventions, manufactures, products and resources of the United States of America will be opened at 3 p.m. on Monday, May 2nd, at Earl's Court, Kensington.

Occurring as it does in the Jubilee year of Her Majesty's reign, and being free from any rival exhibition at South Kensington, the present exposition of America's greatness will have an unequalled opportunity for securing popularity, and which opportunity the executive authorities appear determined to utilise to the best advantage. On a recent visit of inspection we found all departments fully engaged, and we have no reason to doubt but that all will be ready for a successful opening on the date fixed for that ceremony.

The total area of the grounds and buildings amounts to 23 acres, and might, approximately, be said to be contained within a triangle whose sides would terminate respectively in the Earl's Court, West Brompton, and West Kensington stations, from each of which direct communication with the exhibition has been made, and as all the chief railway companies have made arrangements to run direct into these stations, visitors from any part of the country can be conveyed into the exhibition without any occasion to go from under cover, a facility which we have no doubt many will avail themselves of. Further, the choice of one of three stations will do away with the very disagreeable crushing which formed such a prominent and unpleasant feature of the South Kensington shows. The buildings, with the exception of the flooring, consist exclusively of glass and iron, reducing fire risks to a minimum, and affording the greatest amount of floor space. The gardens will be most tastefully laid out, and a complete system of electric illumination has been devised, while the amusements to be provided will be of an entirely novel kind so far as English visitors are concerned.

The exhibits are embraced in five departments, the first relating to all matters appertaining to agriculture, the second to mining and metallurgy, the third to machinery (and in this department we notice much that will be of interest to our readers), while the fourth embraces manufactures generally. The fifth and sixth departments are given up respectively to education and science and the fine arts.

The bulk of the exhibits will be displayed in one long building, divided longitudinally into four main avenues and transversely into ten "Streets," starting, at the entrance, with "First Street" and terminating with "Tenth Street." From a preliminary list of exhibitors that we have been favoured with we can confidently state that there will be many amongst these exhibits that will prove interesting to our readers, and the Board of Direction are to be congratulated on their determination to admit as exhibitors only those firms whose products will tend to impress visitors with the excellence attained by Americans in each branch of industry.

We purpose, during the course of the Exhibition, noticing fully those exhibits which may be of a nature to interest our readers. Formed and carried into execution solely by private enterprise, the project throughout must be regarded as a most plucky one, and we cordially wish the organizers of, and all connected with, the American Exhibition every success in their praiseworthy endeavour to still further popularize the products of their country.

CITY AND GUILDS OF LONDON INSTITUTE.

CONVERSAZIONE AT THE CENTRAL INSTITUTION.

On March 16th about two thousand ladies and gentlemen were invited to meet the Lord Mayor and Sheriffs at a conversazione at the Central Institution of the City and Guilds of London Institute for the Advancement of Technical Education, South Kensington. In addition to the ordinary work of the institute, numerous other attractions were provided in the form of music and objects of interest. The entrance hall was splendidly illuminated, and the spacious apartments and corridors were decorated with pictures and flowers, the electric light being used to produce agreeable effects in conjunction with palms and artificial cascades.

In the library on the first floor the guests were received by the Earl of Selborne (chairman of the council) and Lady Waldegrave, Sir S. H. Waterlow, Bart. (treasurer) and Miss Waterlow, Mr. H. Saunders, Q.C. (chairman of the Executive Committee), and Mrs. Saunders. Amongst the guests were the masters of the following companies, viz., the Clothworkers, the Skinners, the Coopers, the Turners, the Painters, the Plumbers, the Barbers, the Pewterers, the Glaziers, and the Waxchandlers; Mr. Rowlands, Q.C., M.P., Mr. Dodds, M.P., Mr. Shirley, M.P., Mr. Kynoch, M.P., Mr. Norris, M.P., Mr. Charrington, M.P., Mr. Blake, M.P., Mr. Watt, M.P. The Lord Mayor and Lady Mayoress, with Miss Hanson, Mr. G. Hanson, and Lieut-Colonel and Sheriff Kirby arrived shortly after ten o'clock.

A performance of glees, madrigals, and part songs, under the direction of Mr. E. Plater, assisted by Mr. J. A. Brown, Mr. E. Dalzell, Mr. H. Taylor, and Mr. R. Hilton, was given in the Chemical Lecture theatre, on the ground floor, and a concert by the choir and orchestra of the Popular Ballad Concert Committee was given in the large central hall, under the direction of Mr. H. Thomas.

At intervals during the evening the guests visited the workshops and lavatories in the basement, and the fine exhibition of English cut cameos, lent by Mr. J. Marsh; microscopes, lent by Mr. J. Beck; scientific instruments, lent by Messrs. Elliot Bros.; and photographs from the Stereoscopic Company and Mr. W. F. Donkin. In the council-room the Clothworkers, Skinners, Fishmongers, Salters, Carpenters, and Leathersellers Companies exhibited their gold and silver plate, including salvers, loving cups, tea and coffee urns, salts, and ornaments of various kinds. The Skinners' collection comprised several splendid cocks and peacocks in the precious metals. Close by were exhibited a number of Defries' patent safety lamps, and in an adjoining room some young ladies were seated round a well-lighted table, engaged in the delicate work of wood engraving. In another apartment the work of wood carving was being carried on by young people of both sexes. In the technological examinations office were numerous specimens of work done by students of some of the provincial classes in connection with the institute. Messrs. Doulton supplied a number of beautiful pottery specimens designed and painted by artists trained in the Lambeth School of Art. Messrs. Brooke, Simpson, and Spiller exhibited a magnificent collection of chemicals and dye stuffs made therefrom, and silks dyed therewith. There was also a historical collection showing the progress made in the production of art pottery during the last 20 years. In another room the potter was seen at work engaged in "throwing" and "wheeling." Various works of art, including a number of valuable old books and manuscripts, were lent by Mr. C. J. Shoppee, and some models of celebrated diamonds were presented by Mr. W. Chapman.

During the evening scientific lectures were given in different parts of the building, and light refreshments were served in several apartments. Some of the students, who number at the present time 258, acted as stewards, and gave necessary explanations as to the apparatus and exhibits. It should be mentioned that the regular courses of instruction at the institution are specially arranged with a view to enabling students to qualify as technical teachers, mechanical, civil, electrical, and chemical engineers, and as principal superintendents and managers of chemical and other manufacturing works. The fees for matriculated students are £25 per annum.

LAUNCH OF H.M. TORPEDO CRUISER "SERPENT."

On the afternoon of March 10th Her Majesty's ship *Serpent*, torpedo cruiser, one of the largest vessels that have been built at Devonport Dockyard of late years, and the first completed during the tenure of office of the present Chief Constructor (Mr. J. B. Suddy), was successfully launched from Devonport Dockyard, in the presence of about 6,000 persons. Shortly after 4 o'clock the platform began to fill with privileged spectators, the majority of them being naval and military officers and their wives. Among those present were the Mayor and Mayoress of Plymouth (Mr. and Mrs. W. H. Alger), the Naval Commander-in-Chief (Admiral A. Phillimore) and Mrs. Phillimore, Admiral of the Fleet Sir Alfred Ryder, K.C.B., Lady Louisa Fortescue, and Rear-Admiral H. D. Grant, C.B. (Admiral Superintendent of Devonport Dockyard). At half-past four the Rev. Dr. Dickson, chaplain of the dockyard, opened the brief service appointed for the occasion. This over, Mrs. Phillimore, the wife of the Naval Commander-in-Chief, stepped on to the raised dais to christen the ship. Within a minute or two of 5 o'clock Mrs. Phillimore, instructed by the Chief Constructor, severed with chisel and mallet a thin line centred in a beautifully carved Royal coat of arms affixed to the bows of the vessel, and in a second the *Serpent* gracefully took her first dip, in excellent style, amidst the cheering of the onlookers and the strains of "Rule Britannia" and "God Save the Queen" from bands. The *Serpent* was subsequently picked up by the *Scotia* and *Ætna*, dockyard tugs, and towed to a buoy in the Hamoaze, whence she was taken to Keyham to be brought forward for commissioning. After the launch Rear-Admiral and Mrs. Grant were at home to a large party at their official residence on the Terrace. The *Serpent* is a vessel of the *Archer* type, several of which, including the ship from which that class takes its name, are at present lying at Devonport yard. They, however, have been raised in private yards, whereas the *Serpent* has been built in a Government establishment. Her keel was laid down at Devonport on November 9th, 1885. She is built entirely of steel, and all her exposed fittings are galvanized, while her lines are particularly graceful. Her dimensions are:—Length, 225 ft.; beam, 36 ft.; displacement, 1,600 tons. For her size the *Serpent* will be one of the most powerfully armed vessels afloat. She will have six 6-in. B.L. central pivot guns on Vavasseur carriages, eight three-pounder quick-firing guns, two Nordenfeldt, and one seven-pounder. In addition she will be fitted with five Whitehead torpedo tubes, each 14 in. in diameter, one being situated directly in the bow, with one on each side and one on each quarter. Though of the *Archer* class, the *Serpent* is to be supplied with engines that are expected to develop 1,000 more horse-power than any of the vessels that have been delivered to the Government by Messrs. Thomson, of Glasgow.

Messrs. Forrestt and Son recently completed in thirteen working days, for the use of Mr. H. M. Stanley's African party, a steel whale boat, 28 ft. long, 6 ft. beam, and 2 ft. 6 in. deep. It is built of Siemens' steel galvanized, and divided into 12 sections, each weighing about 75 lbs. The fore and aft sections are watertight, giving a large amount of buoyancy to the boat. The sections are bolted together, india-rubber being used between the joints to make them watertight. The boat pulls ten oars, and is fitted with a large lug sail. She will carry 22 men and 1,000 lbs. of baggage on 17 in. draught of water. Fittings are made movable. Each of the sections may be carried easily by two men. The little vessel can be put together in 35 minutes and taken to pieces for transport in 22 minutes.

INDUSTRIAL NOTES.

THE CLYDE AND EAST AND WEST OF SCOTLAND.

THE past month has not witnessed any very solid improvement as regards the amount of fresh work secured for the shipyards and engine shops of the Clyde and its Firth, and those on the Forth and at Dundee. True, of course, the state of matters as last reported has received some change in the shape of orders, but the rate of production is far in excess of the rate at which new work is being contracted for. The number of yards having little or nothing to do is gradually becoming larger, and there is a reluctance even on the part of those works having orders on hand to increase the working hours to the full time usually entered upon at this period of the year. The miners have mostly now returned to work, but only on conditions of an ultimate settlement of matters much as that for which they struck work. Conferences of masters and workmen delegates are being held, and it is hoped a satisfactory and amicable settlement may soon be arrived at. Meantime the interruption to business, both manufacturing and shipping, is not what it was, and it is hoped things may go on uninterruptedly until matters are again rightly adjusted.

Messrs. Russell and Co., Port Glasgow, have now commenced to work full time in each of their three yards—one of which is at Greenock—they having been on three-quarter time during the past winter months. Messrs. A. and J. Inglis, Pointhouse, have intimated that after the 1st April their employées will be engaged full working time. The London and Glasgow Shipbuilding Company on the other hand have begun to work short time, viz., from 8 a.m., to 4.15 p.m. This company—as was reported last month—have put their last vessel into the water, and have nothing to lay down on their vacant berths, and have reduced their their staff to its minimum.

Messrs. A. and J. Inglis, of Pointhouse, have secured an order from the British India Steam Navigation Company for the construction and engining of a steel screw-steamer of about 240 ft. in length, and measuring slightly under 2,000 gross tons. Like the vessels of this company generally, the new steamers will be built to the highest class at Lloyd's. Messrs. Inglis, it may be mentioned, have just completed the screw steamer *Forth* for the Canon Company's new cargo and passenger service between Grangemouth and London. With this vessel they have carried out a series of speed trials of almost unexampled extent, having made no fewer than 36 runs over the measured mile, and finally a trip from Cloch Lighthouse round Ailsa Craig and back. The mean speed over this extended series of trials, with a deadweight cargo of 390 tons on board, was the gratifying figures of 15·18 knots per hour. Messrs. Ross and Duncan, engineers and ship contractors, of Govan, have just received an order from the Government of Tasmania for a screw tug of 450 I.H.P. Messrs. Scott & Co., Greenock, have booked a vessel of somewhat similar size, but for scarcely such prosaic purposes as above. This is a steam yacht of some 500 tons, to be built of steel for a French gentleman. The Ailsa Shipbuilding Company, of Troon, one of the most recently organized shipbuilding and ship repairing businesses established on the Firth of Clyde, are reported to have received an order from a Glasgow firm for two iron vessels of about 450 tons each. They have at present a steel screw launch on hand for the Master of Blantyre, a missionary vessel, and other small work. They have, since the commencement of their business about a year ago, had a great deal of repairing work to do. Messrs. Muir & Houston, Harbour Engine Works, have contracted to supply John Donaldson, Esq., Tower House, Chiswick, with a screw yacht, 190 ft. by 25 ft. by 15 ft. 6 in., to be fitted with a set of triple-expansion engines of the most improved type, to indicate 600 H.P. Messrs. Hannah, Donald & Wilson, of Paisley, have contracted to build and engine a screw steamer 80 ft. long, 18 ft. 6 in. beam, and 9 ft. 6 in. deep, for a foreign firm, the engines being compound surface-condensing. This makes the fourth steamer building on the banks of the river Cart. Messrs. Lobnitz & Co., of Renfrew, are busy finishing the large contract they have on hand, in the shape of a flotilla of hopper barges for Suez Canal improvements. They have also on the slips a powerful dredger and four tug boats for service at Port Said.

A second screw steamer, similar to the one referred to in last month's notes, has been ordered from Messrs. D. & W. Henderson and Co., Partick, by Messrs. J. & A. Allan, of the Allan Line. The vessels are of about 3,000 tons each, and are intended for the cattle carrying trade between the United States and this country. Messrs W. Simons & Co., Renfrew, continue to be fairly well employed with this particular speciality in hopper dredgers. On the 14th ult. they launched one of these powerful craft for the Harbour Trust of Whitby, 112 ft. long by 26 ft. by 12 ft., designed to carry 250 tons of its own dredgings, and to replace it on their stocks they have received instructions to build for the Bombay Harbour Commissioners one of their patent hopper dredgers of about 1,000 tons capacity.

The shipyards of Dumbarton are much in the same condition, as regards work on hand, as last reported. The only fresh fact to chronicle is that Messrs. Murray Brothers, who undertake the construction of small and medium-sized craft at their Dennystown yard, have contracted to build a screw tug for Africa, the machinery for which will be supplied by Messrs. Muir and Houston, of Glasgow. While speaking of Dumbarton, it is only natural that a sentence or two of reference should here be made to the serious blow the whole community has sustained in the sudden death of Mr. William Denny, which occurred at Buenos Ayres on the 17th ult. The sad and unlooked-for intelligence seemed to stun everyone on hearing it, and almost all business operations were suspended for a day. Mr. Denny entered very ardently into everything which he undertook to do, and seemed to have the faculty of inspiring others with the same enthusiasm as he was himself actuated by. His death in the prime of life and in the midst of projects charged with great consequence to his own firm and the large numbers they employ is deplored as a great public loss. The Institution of Engineers and Shipbuilders in Scotland, of which Mr. Denny was a prominent and valued member, at a meeting on the 22nd ult. passed a resolution expressive of sympathy with his relatives, and remarking on the loss the Institute had sustained.

As an illustration of the serious depreciation in shipping property which has taken place, it may be stated that the fine first-class ship *Dunskeig*, 1,769 tons register, built by Messrs. John Reid and Company, Port Glasgow, in 1875, for Messrs. McKinnon, Frew, and Co., Liverpool, has been sold to Messrs. J. Cornfoot & Co., Glasgow. The purchase price is stated to be £9,700, being at the rate of about £5 10s. per register ton. At the period the ship was built the price paid for similar class of vessels was from £18 to £20 per ton. Another fine Clyde-built ship of more recent build was put in the market for sale a few days ago while discharging at Greenock, but the price offered for her, we understand, being considerably under £5 per ton she was withdrawn. At present first-class new iron and steel ships can be built on the Clyde at from £8 10s. to £9 10s. per ton.

Lately a splendid lifeboat was presented to the West Coast of Scotland for service there by Miss Agnes Leighton in commemoration of and named after her two deceased brothers, Captains John and Henry Leighton, who were engaged in the Indian Merchant Service; and now the National Lifeboat Institution has sent a new lifeboat to Ayr, to take the place of a smaller one stationed there many years since, the new craft, with carriage and equipment complete, being the gift of Mr. Thomas Kincaid Hardie, of London. The boat, which is named the *Janet Hoyle*, is 34 ft. long, 7½ ft. wide, and rows ten oars double banked. It possesses all the latest improvements, including water ballast tanks amidship, by which the immersion can be increased at will in the shortest period of time.

An interesting exhibition of lighting on the principle worked by the Cera Light Company, Limited, was given recently in the Glasgow Royal Exchange, and attracted much attention. The new system of lighting is fast growing in favour, several of the leading shipowners having had the ships' signal lamps adapted to the principle with highly satisfactory results as regards strength of light and ease of handling.

Mr. W. R. Kinipple, C.E., who has filled the responsible office of consulting and resident engineer of the Greenock Harbour Trust for a period of over twenty years, has placed his resignation in the hands of the trustees. Mr. Kinipple was appointed to the office which he now resigns when the Garvel Docks were first contemplated. He now proposes to return to London.

At the annual meeting of the subscribers of the Clyde training-ship *Cumberland*, which was held in Glasgow on the 11th ult., Mr. John Burns, of the Cunard Company, who presided, referred to the arming of mercantile vessels for naval purposes in the event of war, and made the important suggestion that boys passing out of such training ships as the *Cumberland* should be transferred for a time to the Royal Naval Reserve, from which they could be taken back into the mercantile cruisers which might be employed for naval purposes in the future.

IN consequence of the death of Mr. Fawcus, Mr. Blakiston, who has for some time been engaged with the firm of Fannery and Fawcus, has joined Mr. Flannery as partner.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—During the month of March enquiries for new tonnage have been less numerous than in either of the two preceding months, and there has undoubtedly been less business done on the Tyne, so far as the placing of new orders is concerned. The most important incident that has taken place in connection with the shipbuilding industry is the handing over of the belted cruiser *Orlando* to the representatives of the Admiralty. This is the first of the five cruisers ordered from different builders in the early part of 1885 that has been made available for strengthening our Naval defences, and the reputation of Messrs. Palmer's establishment can hardly fail to be greatly enhanced by the circumstance. The other cruiser which was entrusted to Messrs. Palmer, and which has been named the *Undaunted*, will be ready for delivery about Midsummer, and there is now little reason to doubt that this firm will enjoy the unique distinction of being the first to complete the portion of work which fell to their share out of the considerable total given out by the Admiralty at the period mentioned. The completion of the *Orlando* necessitated the discharge of a good many hands, and it cannot be said that at this moment much activity is noticeable in the yard. There are several berths empty, but an impression exists that two or three of them will shortly be occupied by cruisers for a Continental government. It was some time ago announced that this firm were about to engage in an enterprise of a new and interesting character. Details were not given at the time, but it has now transpired that the new departure is to be the manufacture of the "Maxim Gun." Arrangements are now in progress for the commencement of the new branch of business, which, it is understood, will be carried on on an extensive scale. Preparations are now being pressed forward for launching the *Renown*, at Elswick, on April 9th. There is nothing else at present on the stocks, but the firm have a large war ship to build for the Italian Government, and the keel blocks for this vessel are laid. The work of frame-turning has been delayed, however, owing to an alteration of design which is now being carried out. Material is being received for two small vessels ordered by the Thames Conservancy, and frame-turning for these will shortly be commenced. At Messrs. Armstrong & Mitchell's Low Walker yard, business keeps exceedingly brisk, and Messrs. Richardson's yard at the same centre is showing improvement, as the framework for a vessel of the largest class has been commenced. Messrs. Swan and Hunter have three large vessels on the stocks, besides a couple of smaller ones, and the state of briskness at their yard is quite exceptional. Messrs. Hawthorn and Leslie, besides having three vessels in advanced stages, have just completed the framing of a 3,000 ton steel steamer, and another of similar size and type is to be proceeded with immediately. Messrs. Wood & Skinner, who, as stated last month, commenced the construction of two small river steamers, have now the keel laid for a steel cargo steamer to be 250 ft. long. The yard belonging to Messrs. R. Stephenson & Co., at Hebburn, which has been closed for about two years, is to be re-opened immediately. The firm have secured some orders, and the first vessel to be laid down is a 3,000 ton steel steamer, the frame material for which has already been ordered. When once started, there is very little doubt that this yard will rank amongst the first-class shipbuilding establishments on the Tyne. The engines for the vessel just referred to, as well as all other engines for vessels to be built at this yard, will be manufactured at Messrs. Stephenson's old established marine and locomotive engine works, South Street, Newcastle. The Wallsend Slipway and Engineering Company are almost unprecedentedly busy just now, having no less than a dozen sets of triple-expansion engines to build, and two or three sets to alter and repair. The Neptune Works, and Messrs. Readhead's Works are also very busy, and the engine works at Jarrow and St. Peters, though not so briskly employed as they were a short time since, are still having a fair supply of work. Business at Messrs. Black & Hawthorn's Works, Gateshead, has greatly improved within the past few weeks. The firm have secured orders for three sets of marine engines, and they have also a large amount of locomotive work. Messrs. Abbot have only a limited amount of work in any of their departments at present. It is understood that the firm is likely to obtain an important colonial contract for which they tendered some months ago. The matter, however, is not yet definitely settled. It is also stated that they are about to utilize steel as a material for cable chain, instead of the superior quality of iron that has hitherto been employed. There is no change to note at Messrs. Hawks, Crawshay & Son's works, the bridge department being the only one which is busy. Messrs. Clarke, Chapman and Parsons are developing the electric light branch of their business with great success. They are also getting more work in their windlass, crane, and steering gear departments. Messrs. Carrick & Wardale are having a very satisfactory demand for their bilge and ballast pumps, and their works are kept steadily going. At Messrs. Armstrong & Mitchell's ordnance factory, Elswick, the pressure of work which for two or three years has been very great is sensibly diminishing. The falling off is particularly noticeable in the shell department, from which a good many hands have been paid off lately. It is stated that in many of the shops the discontinuance of night work is contemplated. Messrs. Cail & Davies, Iron and Steel Works, Redheugh, are now very fairly employed. The demand for sheets used in tank construction and for other purposes is strengthening, and this firm, who make this class of work a specialty, are feeling the benefit of the increased demand.

The Wear.—No new orders of importance have been booked by Wear shipbuilders during the month, but some extensive repair contracts have been put in execution, and this has to some extent compensated for the absence of orders in the other branch of the industry. Several launches of special interest have taken place during the month. Among these may be mentioned the *Lake Ontario* and the *Pio IX.*, both launched on the 10th. The first-mentioned vessel is a splendid passenger steamer ordered by the owners of the Beaver line, and intended for the Atlantic trade. The vessel is, without doubt, one of the finest ever turned out from the Deptford yard. The second vessel refered to was built for Spanish owners by Messrs. Boolds and Sharer of the High Yard, Pallion, and besides being a vessel of enormous carrying capacity, is most creditably finished and fitted up with all the modern appliances used on first class steamships. Later on in the month another vessel of special type was launched from the North Sands yard. This was a passenger steamer ordered by the New Isle of Man Steam Navigation Company. The vessel has been an unprecedentedly short time in course of construction, having been commenced within the present year. This is the fastest vessel ever built on the Wear, her estimated probable speed being 20 miles an hour. The vessel is intended to convey passengers between Liverpool and the Isle of Man during the ordinary excursion season, and will be put on the station in a very few weeks from now. The firm will launch three other vessels (all of large size) by the end of April. This firm, who miss no opportunity of adding to the effectiveness of their plant, have just put in operation a new machine for cutting angle bars obliquely, and also for dividing bevelled bars without altering the shape. This work, which could not be done by the ordinary shearing machines, has hitherto involved the expenditure of considerable labour, but much better results, so far as finish is concerned, are now obtained with comparatively little trouble. This is the only machine of the kind which has yet been introduced on the Wear. Messrs. R. Thompson & Sons are proceeding with the construction of a large vessel, and they continue to secure a satisfactory proportion of the repair contracts that are on offer. Messrs. Short Brothers launched two vessels during the month, and they have received the frame material for two others. These latter are steel cargo steamers of large size. Messrs. Osborne & Graham have lately enlarged their yard by enclosing a piece of unoccupied ground in the vicinity. The firm are as yet without orders, and their machinery is still standing. The extension of premises just referred to, however, shows that they have not wholly lost confidence in the future. The improved tone mentioned in former reports is still maintained in the engineering trade. Messrs. Dickinson have received several orders for marine engines and boilers during the month, and they are daily having inquiries for their patent crank shafts. Messrs. Clark, of the Southwick Engine Works, are also quite busy, and Messrs. Doxford are doing a steady trade. The North-Eastern Engineering Company are busy with the preliminary work in connection with the contract for pumping machinery for a London waterworks. Messrs. Carr & Co. are contemplating the carrying out of important alterations which will enable them to place the engines and boilers in vessels beside the works. At present they have to utilize facilities at a distance for this purpose, which is, of course, a source of great trouble and expense. Messrs. C. and M. Douglas, of the Bedford Street and Low Quay Engine Works, have lately been engaged in repairing the engines and boilers of the s.s. *Broomhill*. The firm are negotiating for other contracts of the same description, and they are well occupied with general repairs for local manufacturing establishments.

The Hartlepools.—The shipbuilders at this centre continue to be well provided with orders. Some launches have taken place during the month, and keels have been placed in the vacated berths. The marine engineering establishments continue to show considerable activity, and the local rolling-mills keep fairly well employed.

The Tees.—At Stockton, and also at Middlesbro', the shipbuilding yards are generally doing a steady trade, but in one or two establishments some approach to the activity of former years may be noticed. The state of work in engineering establishments is not uniformly satisfactory, but many of the foundries are busy, and steel works continue to exhibit great briskness.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of THE MARINE ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

Le Morbhan.—On February 23rd a vessel, built by Messrs. Hawthorn, Leslie and Co. (Limited), at Hebburn, for the Compagnie Generale Transatlantique, was launched. She is intended for general coasting trade purposes, and is 230 ft. by 33 ft. by 21 ft., with triple-expansion engines of 1,000 I.H.P. The vessel was christened the *Le Morbhan* by Madame Quentin.

Royal Jubilee.—On February 23rd there was launched from the shipbuilding-yard of Messrs. Joseph L. Thompson and Sons, North Sands, Sunderland, a steel steamer of 3,800 tons deadweight carrying capacity. This vessel is of the following dimensions:—Length, 312 ft.; breadth, 40 ft.; depth of hold, 25 ft.; and is built on the longitudinal cellular bottom system, under special survey for the highest classification, and also under the regulations of the Board of Trade for passenger certificate. Six steel bulkheads are fitted, the main deck is of steel fore and aft, and the upper deck of steel for half the vessel's length, which is also covered with yellow pine. The accommodation for captain and spare state-room are in full poop aft, and the officers' and engineers' rooms, &c., are under the bridge-house amidships, which extends for the entire length of the machinery space. Berths for the petty officers and crew are fitted in the topgallant forecastle, and likewise lamp and store rooms, with side light-turrets of steel, which are placed on the forecastle deck. The engines are of 1,400 I.H.P., of the triple-expansion type, and have been built by Messrs. Thomas Richardson and Sons, having all the latest improvements recently applied by them to engines of this type. The naming of the vessel *Royal Jubilee* (*pro. tem.*) was performed by Miss Knight, of Sutton, Surrey.

Verulam.—On February 23rd there was launched from the shipbuilding yard of Messrs. S. P. Austin & Son a screw steamer of the following dimensions:—Length, 259 ft.; breadth, 36 ft.; depth in hold, 17 ft. 4½ in.; tonnage, about 1,075 net, 1,660 gross. Classed 100 A1 at Lloyd's. Built under special survey, with full forecastle, bridge house, raised quarter deck, short full poop, partial double bottom for water ballast, patent windlass, four cargo winches and boiler, combined steam and hand steering gear. Engines, triple-expansion, 19 in., 31½ in., and 51 in.; stroke, 36 in. Two steel boilers, 160 lbs. pressure, by Blair & Co. (Limited). As the vessel left the launching ways she was named *Verulam* by Mrs. Austin.

Tockwith.—On February 25th a new steamer, built of steel, by the firm of Messrs. John Readhead & Co., South Shields, was launched from their yard at the West Dock. Her dimensions are as follows:—Length, 280 ft.; breadth, 38 ft. 9 in.; depth of hold, 19 ft. 6 in. The engines are of the triple-expansion type, having cylinders 21½ in., 36 in., and 59 in., with a piston stroke of 39 in. Steam will be supplied by two steel boilers, fitted with Fox's patent furnaces, 160 lbs. working pressure. The vessel is constructed on the well-deck principle, having a long bridge and topgallant forecastle. She has been built to the order of Messrs. Groves, M'Lean & Co., of West Hartlepool, and is the fifth vessel built by Messrs. Readhead & Co. for that firm. As she left the ways she was named the *Tockwith* by Miss M'Lean. It should be stated that the engines were also supplied by Messrs. Readhead & Co. They will work on a very economical consumption. The vessel is intended for the Indian, American, and Mediterranean trades. She is fitted with patent capstan windlass by Emerson Walker & Thompson Bros. (Limited), and with all the appliances necessary for grain cargoes, and will carry from 3,200 to 3,300 deadweight on a light draught of water. The *Tockwith* has been built under the superintendence of Mr. Abey, the company's inspector, and is classed 100 A1 at Lloyd's.

Steel Built Screw Steamer.—On February 26th Messrs. Newall and Co. launched from their yard in St. Phillip's, Bristol, a steel built screw steamer, measuring 70 ft. by 13 ft. 6 in. by 7 ft. 5 in. moulded depth. This vessel is one of a duplicate order received from the Turkish Minister of Marine, and is similar to the two vessels supplied by the same firm to the Turkish Government in February of last year, being intended for service in the Constantinople harbours. These vessels have been built under Lloyd's and Board of Trade survey, and are fitted with compound surface condensing engines, steel boilers, carrying 100 lbs. steam pressure, combined steam winches, and windlasses capable of lifting torpedoes when required.

Luna.—On March 8th there was launched from the shipbuilding yard of Messrs. W. White & Sons, Vectis Ironworks, West Cowes, a steam yacht named the *Luna*, built to the order of Major Bridson, of Torquay. The vessel is built of steel, and classed 100 A1 at Lloyd's. She is of 100 tons, and her principal dimensions are:—Length overall, 111 ft.; length on water line, 90 ft.; beam, 15 ft. 1 in.; depth, moulded, 9 ft. 3 in. She is supplied with a pair of compound surface condensing engines of 25 H.P.; cylinders, 13 in. by 27 in.; stroke, 16 in. The vessel has been supplied with a steel horizontal return tubular boiler, constructed to meet all the requirements of Lloyd's, and will work up to 100 lbs. pressure. The whole of the machinery and boiler has been constructed by the builders of the vessel.

Lake Ontario.—On March 9th there was launched from Mr. James Laing's Deptford Yard, Sunderland, the *Lake Ontario*, built for the Canada Shipping Company (Limited), of Liverpool, trading as the Beaver Line. The principal dimensions of the vessel are as follows:—Length overall, 392 ft.; breadth, 43 ft. 4 in.; depth, 32 ft. 8½ in. The displacement on Lloyd's load-line is about 8,300 tons, and the gross tonnage about 4,520 tons. She has been classed 100 A1 (steel) at Lloyd's, "three decks," but is built considerably above their requirements. In view of the possibility of the vessel steaming among floating ice, the plating of the bows has been doubled and strengthened with extra keelsons and stringers. In the vessel's construction special care has also been taken to make everything amply strong to withstand the tremendous seas of the North Atlantic. The *Lake Ontario* has been specially constructed to pass the Board of Trade survey for passengers, as well as the English and American survey for emigrants. It is intended to place her on the Admiralty list as a transport, and in time of war she would prove a valuable addition to our Navy.

Pius IX.—On March 9th there was launched from the shipbuilding yard of Messrs. Boolds, Sharer & Co., a handsomely modelled steel screw steamer. Prior to the vessel going into the water the Rev. Father Turnerelli, of St. Mary's Roman Catholic Church, in full canonicals, walked slowly round the ship, and also on deck, sprinkling the sides and giving the benediction. Miss Dickenson, of Sunderland, performed the christening, naming the vessel *Pius IX*. The principal dimensions are:—Length over all, 400 ft.; breadth, 43 ft.; and depth, 29 ft. 9 in.

Steel Screw Steamer.—On March 9th Messrs. Edward Withy & Co., Hartlepool, launched a fine steel screw-steamer from their yard. The dimensions are 275 ft. by 37 ft. 2 in. by 20 ft. 7 in., and she will carry a very large deadweight cargo. Her bridge, quarter, main and topgallant forecastle decks are of steel and iron; the charthouse, galley, engine room and cabin skylight, bulwarks, rails, &c., are of iron; she has also four watertight bulkheads, and is fitted with Withy & Sivewright's patent double bottom for water ballast—all fore and aft. The vessel will have a patent steam windlass by Emerson Walker and Thompson Bros., four steam winches, large donkey boiler, steam steering gear amidships, right and left hand gear aft, stockless anchors, hauling up into hawse pipes, and will be rigged as a two-masted fore and aft schooner, with iron pole masts. The

cabin is fitted up in the poop, and constructed of hardwood, with elegant hand-painted panels by the decorative staff of the firm. The steamer will be fitted with triple-expansion engines by Messrs. Blair & Co., Stockton-on-Tees.

Wildfire.—On March 10th there was launched from the shipbuilding yard of Mr. J. S. White, of East Cowes, a screw steam yacht for General C. Baring, of Nubia House, Cowes. The yacht is built of mild steel, and is of 60 tons. Her dimensions are:—Length over all, 97 ft. 6 in.; breadth (extreme), 12 ft.; depth (moulded), 7 ft. 4 in. She is to be supplied with a pair of compound surface-condensing engines by the builder, and he will also fit her with his patent "turn-about" rudder. The vessel was named the *Wildfire*, the christening ceremony being performed by Miss Freda Grant, daughter of R. T. A. Grant, Esq., J.P., of Staffa, Cowes.

Toxteth.—On March 12th there was launched from the Shipbuilding and Engineering Works of Messrs. Oswald, Mordaunt and Co., at Southampton, an iron sailing ship of about 2,500 tons net register, built to the order of Messrs. R. W. Leyland & Co., and of the following dimensions:—Length, about 320 ft. 6 in.; breadth, 41 ft. 7 in.; depth of hold, 24 ft. 5 in. The vessel is full-rigged and built to class 100 A1 at Lloyd's. She has a turtle back aft, long bridge, and deck amidships for accommodation of captain, officers, and apprentices, whilst the crew is housed in the fore end of the same. On the bridge deck a large deckhouse is fitted for chart room and wheelhouse. An iron deckhouse is fitted forward of the bridge for petty officers and galley. Two double-powered winches are fitted, and one portable winch for working cargo, &c. There is also a long monkey forecastle for working anchors. The vessel has been built under the superintendence of Captain Enright. The vessel was launched and named *Toxteth* by Mrs. Green, sister of the Mayor of Southampton.

Wave.—On March 12th Messrs. W. Gray & Co. launched from their yard a fine steel screw steamer of the following dimensions:—300 ft. by 38 ft. by 22 ft. 2 in. moulded, to carry 3,450 tons, built to the order of Messrs. R. Ropner & Co., of West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing handsome saloon and cabins for officers and a few passengers, long raised quarter deck connected to the bridge amidships, the bridge being carried over the machinery space; coal bunkers and main hatch right up to the fore hatch, covering in the lowest part of the ship, and adding greatly to her strength and safety; comfortable quarters will be provided in the bridge for the crew. The usual topgallant forecastle is fitted forward with Emerson Walker & Co.'s patent windlass. The hull is built on the web frame principle, dispensing with hold beams, and giving a clear hold for working cargo. The bottom is coated with patent cement, five hatches are fitted, four steam winches, two donkey boilers and water ballast in double bottom under each hold, and the vessel is in every respect well-equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. T. Richardson & Sons, West Hartlepool. During construction the vessel has been superintended by Captain C. B. Rooke. The christening ceremony was performed by Mr. Arthur Serena, of the firm of Galbraith, Pembroke & Co., London, the vessel being named *Wave*.

Lancashire Witch.—On March 23rd the steel steamer *Lancashire Witch*, the first of the fleet of boats of the New Isle of Man Steam Navigation Company, Limited, was successfully launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, shipbuilders, Sunderland, constructed from designs by Mr. J. R. Oldham, C.E., of 15, Water Street, Liverpool. The dimensions of this vessel are:—Length over all, 235 ft.; breadth, 30 ft.; depth to shade deck, 21 ft.; and has been constructed under special survey of the Board of Trade, and considerably in excess of the requirements of Lloyd's for the 100 A class. This vessel is intended to run between Liverpool and the Isle of Man, and will have accommodation for about 750 passengers, and, under ordinary circumstances, is expected to attain a speed of 20 miles an hour. The model has been on exhibition for some time in Liverpool and Manchester, and has been much admired. The promenade deck is most spacious, and ample accommodation is provided on the main deck in the deck-houses for first and second-class passengers. The upper and lower saloons will be handsomely fitted and upholstered in Utrecht crimson velvet, whilst the panels of the lower saloon contain views of glen and lake scenery and floral designs. The deck-saloons, dining-saloons, ladies' cabins, captain's state-room, lavatories, bars, and pantries, wheel-house and engine-room, will be lighted with the electric light, each lamp being of 20 candle-power, the installation being fitted by Messrs. Dorman & Smith, of Manchester. The deck machinery consists of direct steam windlass by Messrs. Emerson, Walker and Thompson Brothers, Limited, of London; also steam capstan, aft, by the same makers. The steering gear is one of Lynn's horizontal steam steering gears, amidships, and is of a very powerful description; the steam winch is fitted by Messrs. Dunlop, Bell & Co., of Liverpool. There are four boats, which are fitted with Mr. William Mill's patent disengaging gear, and the usual requirements of the Board of Trade as to life-buoys, life-belts, &c. The arrangements and accommodation for the comfort of steerage passengers are much superior to those which generally prevail, and will undoubtedly go far to make the New Isle of Man Company's boats popular. The engines are of the most modern triple-expansion type, and have been constructed by Mr. John Dickinson, of the Palmer's Hill Engine Works, Sunderland, and are likewise of special design and construction to run at a high piston speed to develop the desired power. The cylinders are 23 in., 37 in., and 60 in., with a stroke of 36 in., and will be fitted with Mr. John Dickinson's patent crank shaft, so suitably designed for the triple-expansion engine. The boilers are of steel, and have very large heating and grate surfaces, with Fox's patent corrugated furnaces. It is anticipated that the engines will indicate about 2,000 H.P. The *Lancashire Witch* will be fitted with two iron pole masts, with fore and aft rig, the funnel being oval in form, giving the vessel a very smart appearance. The ceremony of naming the vessel the *Lancashire Witch* was performed by Mrs. Robert Thompson, of Fulwell West House, Sunderland, the launch being witnessed by a number of friends of the owners and builders. The building of this vessel has only occupied twelve weeks, the keel being laid on the 22nd of December last. Another launch will shortly take place from this yard.

LAUNCHES.—Scotch.

Rajapuri.—On February 26th the Grangemouth Dockyard Company launched from their shipbuilding yard a handsomely modelled steel screw awning decked steamer for the Eastern passenger traffic. Dimensions:—Length, between perpendiculars, 155 ft. by 26 ft. by 9 ft. 6 in.; 16 ft. 6 in. to awning deck. Decks of teak. The vessel will be fitted with electric light throughout, including masthead and side signal lamps, steam windlass and steam warping capstan, and all the latest improvements and Board of Trade requirements for passengers. The engines, which are of the most approved style of triple-expansion, are being fitted on board by Messrs. Dunsmuir & Jackson, Govan Engine Works, Glasgow. They are of large power, and are expected to drive the vessel at a high rate of speed. Howden's forced draught is also being fitted. The ceremony of naming the vessel *Rajapuri*, was gracefully performed by Miss MacPherson, Park House, Grangemouth. It is worthy of notice that it is only seven weeks since the vessel was commenced. She is expected to sail for Bombay in about three weeks. After the launch a large party of ladies and gentlemen partook of cake and wine in the Company's designing room when the usual toasts were proposed and responded to.

Yarmouth.—On February 28th Messrs. A. M'Millan and Son launched from the dockyard at Dumbarton the steel screw steamer *Yarmouth*, built to the order of the Hon. Loran E. Baker, for the Yarmouth Steamship Co., of Yarmouth, Nova Scotia. The new steamer is intended for the passenger trade between Yarmouth (N.S.) and Boston (U.S.), and is of the following dimensions:—Length, 220 ft.; breadth, 35 ft.; depth, 21½ ft.; and she is being fitted with accommodation for about 300 passengers, having rooms on the main and upper decks, the latter in a house extending nearly fore and aft. The first-class rooms are large and well lighted, and will be fitted with every comfort for the passengers, including electric lights, which are to be placed throughout the vessel. The machinery, of the triple-expansion type, is being supplied by Messrs. D. Rowan and Son, Glasgow, and will develop 2,300 H.P., and propel the vessel 14 knots. The *Yarmouth* received her name from Mrs. J. Albert Black, Row.

Iron and Steel Lighter.—On March 1st there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, an iron and steel lighter, No. 30, for the Redding Colliery Company, Polmont. Dimensions:—66 ft. by 11 ft. 6 in. by 4 ft. 3 in. moulded. This is the last of three recently launched for the same company, and constitutes the eighth vessel constructed to their order by Mr. Cumming within the last two years.

Nederland.—On March 1st the Fairfield Shipbuilding and Engineering Co., Limited, launched from their yard at Govan a steel paddle steamer, named the *Nederland*, of the following dimensions:—Length, 286 ft.; breadth moulded, 35 ft. 3 in.; depth moulded, 23 ft. 3 in.; with a gross tonnage of about 1,700 tons. The steamer has been constructed to meet the requirements of Lloyd's for Channel service, with all the latest improvements. She will be fitted with a set of compound oscillating engines, with surface condensers, and four single-ended cylindrical tubular boilers of steel, which will enable the steamer to attain a high rate of speed. This steamer is a sister ship to the *Engeland* and *Duitschland*, launched by the Fairfield Company in November and December of last year. These three steamers have been constructed to the order of the Zeeland Steamship Co., of Flushing, Holland, and are intended for a new daylight service between Queenboro' and Flushing. As the steamer left the ways the ceremony of naming her was performed by Miss Elderton.

Samson.—On March 5th Messrs. Barclay, Curle & Co., Limited, Whiteinch, launched a buoy vessel of a somewhat unique character, built for the Port Commissioners of Rangoon, and intended to lay and recover buoys, moorings, lost anchors, and chains, in the district over which the Commissioners have jurisdiction. The vessel is 205 tons, her length being 115 ft., breadth, 23 ft., and depth, 12 ft. 4 in. She is strongly built, and her machinery being also of great strength, she is appropriately named *Samson*. Her fittings include an enormously heavy machine, capable of raising the heaviest moorings; 32 in. chain cables; steam windlass to heave out on the one side and heave in on the opposite side at the same time; two powerful steam capstans, the one to raise 40 tons, heavy bow and stern davits, and appliance for carrying the largest class of buoys to sea. She has also a peculiarly formed bowsprit adapted for raising and lowering heavy weights. A boiler has been fitted on board, with capacity to supply steam to work all the machinery simultaneously. All the chain pipes throughout the vessel are of steel, being a special class of make to withstand the heavy strains and jerks which will be brought to bear upon them when the vessel is employed. The *Samson* is rigged as a brigantine, and will sail to Rangoon under the command of Captain Cottier, London.

Bellena.—On March 9th Messrs. D. & W. Henderson & Co. launched from their yard at Meadowside, Partick, a screw-steamer named *Bellena*, built of steel, to the order of Messrs. Bell Brothers & M'Lelland, Glasgow, and intended for the general carrying trade. This vessel is similar in every way to the *Bellaura*, launched in January, and to another being built in Messrs. Henderson's yard at present. The dimensions of the steamer are as follows:—Length, 310 ft.; breadth, 39 ft.; depth, 26 ft. 6 in.; her gross tonnage being 2,800 tons, and her carrying capacity 4,000 tons. The vessel will be fitted with triple-expansion engines of 1,300 H.P., the working pressure being 160 lbs., and also with Napier's direct-acting windlass. Steam-steering gear will also be provided by Messrs. Muir & Caldwell, Glasgow. While really a cargo-carrying steamer, the *Bellena* has a commodious saloon aft, having accommodation for 12 passengers, the officers' quarters being under the bridge.

Guillemot.—On March 9th Messrs. J. Mackenzie & Co. launched from their shipbuilding yard at Leith a wooden steam fishing vessel named *Guillemot*, 70 ft. in length, 18 ft. in breadth, and 9 ft. in depth, built to the order of Mr. T. F. Robertson Carr, of North Shields. The vessel is intended for the deep sea net and line fishing, and will be supplied with machinery by Messrs. Hawthorn and Co., Leith.

Mab Queen.—On March 9th Messrs. Russell & Co. launched from their Port Glasgow East-End yard a handsomely-modelled iron barque of 1,000 tons net register, and of the following dimensions:—Length, 204 ft.; breadth, 33 ft. 6 in.; depth of hold, 19 ft. 6 in. This vessel has been constructed to the order of Captain Fairlie, Glasgow, to the highest class at Lloyd's, with all the latest improvements for loading and discharge of cargo. On leaving the ways she was named *Mab Queen*. She will fit out at Port Glasgow, and will afterwards proceed to Glasgow to load.

Kenilworth.—On March 12th Messrs. Reid & Co. launched from their shipbuilding yard, Port Glasgow, a four-masted steel ship, built to the order of Messrs. Williamson, Milligan & Co., Liverpool. As the vessel left the ways she was named *Kenilworth* by Miss Burns, of Castle Wemyss. This is the sixth ship Messrs. John Reid & Co. have built for the same firm. She is fitted with one of Emerson, Walker & Thompson's new patent direct-acting windlasses with capstan on forecastle, and her dimensions are:—300 ft. by 43 ft. beam by 24·3 ft. depth of hold. She has a gross register tonnage of about 2,300 tons. After completion the *Kenilworth* will be under the command of Captain M'Nair, late of the *Cedric the Saxon*.

Hopper Dredger.—On March 14th Messrs. William Simons and Co., Renfrew, launched a hopper dredger which has been built to the order of the Piers and Harbour Trust, of Whitby. She measures 112 ft. by 26 ft. by 12 ft., and is supplied with compound surface-condensing engines of 200 I.H.P. The dredger has been specially fitted with several of the builders' latest improvements, and will cut its own flotation through shoals and banks.

Rhine.—On March 21st Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port Glasgow, launched from their yard a steel screw steam tug named the *Rhine*. This vessel is similar in construction and design to the *Danube*, built for the same owners, viz., the London and Tilbury Lighterage Company (Ltd.), of London, by the Messrs. Dunlop in June of last year. The dimensions of the *Rhine* are:—Length, 70 ft.; breadth, 16 ft.; depth in hold, 9 ft. 4 in., and she has been built under Lloyd's special survey for 100A class, with excessive strength for dock work. The vessel is being fitted by her builders with triple-expansion engines capable of exerting 300 H.P., combined hand and steam steering gear and a direct steam windlass are provided to facilitate quick handling and manœuvring of the vessel in the docks.

Fatshan.—On March 21st Messrs. Ramage and Ferguson, Leith, launched from their yard a steel twin-screw steamer, named the *Fatshan*, built to the order of the Hong Kong, Canton, and Macao Steam Shipping Company, for their night service. The dimensions are:—Length, 280 ft.; breadth, 54 ft.; depth, 28 ft. 6 in. The steamer will be fitted with triple-expansion engines of sufficient power to drive her at a speed of 11½ knots. The passenger accommodation embraces large European, Parsee, and Chinese saloon extending the whole length of the steamer, with ample sleeping accommodation. The steamer has a double bottom throughout, and is in every respect suitable for the East.

Hopper Barge.—On March 23rd Messrs. Lobnitz & Co., engineers and shipbuilders, Renfrew, launched the first of a series of hopper barges which they are building to the order of the Suez Canal Co., to be employed on the works of the Canal. These hopper barges are built of iron, and are 135 ft. long by 25 ft. beam by 11½ ft. deep. They are propelled by two pairs of compound engines, working the twin propellers independently, and indicating collectively fully 300 H.P. After the launch the hopper barge was moored in the builders' wet dock, where she will receive her machinery, constructed by Messrs. Lobnitz & Co., and be rigged and fitted out for her voyage to Port Said. Messrs. Lobnitz & Co. are building for the same Company a very large and powerful dredger, specially designed for the removal of the hardest strata to be dealt with in the Canal. They have also under construction a large crane pontoon designed for discharging machinery and heavy goods from large transatlantic steamers, and conveying these to the wharf in the Harbour of Colon.

Nouvelle Voldrogue.—On March 23rd the Grangemouth Dockyard Company launched from their shipbuilding yard on the Forth a handsomely-modelled steel screw steamer, of which the following are the particulars:—Length, between perpendiculars, 150 ft. by 22 ft. by 10 ft. Built under Lloyd's special survey for their 100 A1 class, and Board of Trade for boats, lights, &c. She has a saloon deck extending from bridge house, aft, containing large saloon for first-class passengers, ladies' cabin, pantry, and smoking-room, and every other convenience. She will be handsomely fitted up and upholstered, and special arrangements have been made for thorough ventilation for trading in a hot climate, ice house and specie and mail room. Accommodation is also fitted forward for second class and steerage passengers. The vessel is to be fitted up with all the latest improvements for working both vessels and cargo, and will be fitted throughout with electric light. The ship will be rigged as a two-masted schooner. The engines are being fitted on board by Messrs. Dunsmuir and Jackson, Glasgow. The vessel is built to the order of Messrs. W. E. Roberts and Co., Liverpool, for General B. Riviere, on behalf of the Haitian Government, and is intended to trade on the coast of Haiti, and to carry the mails. Previous to the launch, a religious service was performed by the Rev. Father Hamma, of Glasgow, according to the rites of the Catholic Church. The ceremony of naming the *Nouvelle Voldrogue* was performed by Mrs. Magill, Gowan Lea, Grangemouth. The company afterwards adjourned to the offices of the builders and partook of cake and wine luncheon, when the usual

toasts were proposed and responded to. The Grangemouth Dockyard Company have two other vessels on the stocks—exact duplicates of the one launched for the same owners.

Armadale.—On March 24th Messrs. Alexander Stephen and Sons, Linthouse, Govan, launched from their shipbuilding yard a large and beautifully modelled iron four masted sailing ship of about 2,000 tons gross register, classed 100 A1 at Lloyd's, with extras beyond their requirements. She has been built to the order of Messrs. J. & A. Roxburgh, of Glasgow, and from her fine lines it is confidently anticipated that she will prove a fast sailer, and a worthy addition to their present fleet. The captain and officers have handsome accommodation in the after poop, while the crew and petty officers are comfortably lodged in iron houses on deck. The vessel is provided with a steam winch and all the most recent appliances for the efficient working of the ship and cargo, and will be commanded by Captain William Duncan. As she left the ways she was gracefully named the *Armadale* by Miss Barclay, of Park Terrace, Glasgow. The Messrs. Stephen have a duplicate vessel on hand—well advanced—for the same owners.

Ionia.—Messrs. A. M'Millan & Son launched from their dockyard at Dumbarton a very fine steel screw-steamer of about 1,500 tons register, named the *Ionia*. This vessel, which is intended for trading in the Mediterranean, Ægean, and Black Seas, is fitted up in a handsome manner for a considerable number of first and second-class passengers, all the accommodation being on deck in a poop for the first-class, and below aft and an extended forecastle for the second-class. Below the line of the main deck the remainder of the space is reserved for cargo. It is intended to fit the electric light throughout the vessel, as well as all the most modern improvements for economy and efficiency. The machinery, which is being supplied by Messrs. D. Rowan & Son, Glasgow, is on the triple-expansion type, and will indicate about 1,700 H.P., and propel the vessel at a speed of 13 knots. Weir's feed-heater pumps and distiller for preservation of the boilers and economy of fuel are also being fitted by Messrs. Rowan & Son. The *Ionia*, which received her name from Miss Kate M'Millan Colls, London, is the first of three similar vessels Messrs. M'Millan & Son received an order for last October. The other two vessels are being rapidly advanced towards completion.

LAUNCHES.—Irish.

Kathleen.—On March 3rd Messrs. Workman, Clark & Co., Limited, launched from their shipbuilding yard at Belfast, an iron screw steamer, named the *Kathleen*, specially designed and built for the coal trade between that port and Liverpool. She is owned by Mr. John Milligan, coal merchant, Belfast. The special features of this steamer are high speed, large carrying capacity, with a small register tonnage; large hatches, enabling her to rapidly load and discharge her cargo; extra strength of bottom to avoid injury in case of grounding when entering the lough at low tide; and sufficient water ballast in fore and aft peaks to enable her to cross channel comfortably without either ballast or cargo. Her dimensions are:—Length, 155 ft. 6 in.; breadth, 23 ft.; depth to top of floor, 11 ft. 11 in. She has been built to class 100 A1 at Lloyd's under special survey, has an iron main deck, bridge, topgallant forecastle, and short raised quarter-deck. The captain is berthed amidships, officers and engineers aft under raised quarter-deck, and the crew and firemen under main deck forward. The vessel is rigged as a fore-and-aft schooner, with special arrangement of derricks for discharging, when cranes cannot be had; and there are two powerful steam winches and a coal whip on deck, and an Emerson and Walker's patent windlass worked by levers, and a messenger chain from fore winch. After launching, the vessel was towed to Glasgow to receive her machinery, now being constructed by Messrs. J. and J. Thomson, and will return to be completed at Belfast.

Corsican.—On March 9th Messrs. Workman, Clark & Co., Limited, launched from their shipbuilding works at Belfast, a steel screw steamer named the *Corsican*, for the firm of Messrs. J. and J. Macfarlane & Co., Glasgow. Her lines are very fine and her engines of great power. She has a long raised quarter-deck, bridge, and topgallant forecastle, water ballast tanks arranged under the after hold and in fore and aft peaks. There is a saloon and ladies' cabin under the bridge for the accommodation of passengers. The officers are berthed aft, and the crew forward, under the main deck. She will be rigged as a fore-and-aft schooner, and has two steam winches and a patent lever windlass. Boiler is made of steel, and her engines are triple-expansion, having cylinders 15, 24, and 40 in. diameter, by 33 in. stroke. The vessel's dimensions are:—Length, 150 ft.; breadth, 22 ft.; depth of hold, 10 ft. 6 in.; and is classed 100 A1 at Lloyd's under special survey.

LAUNCH.—Danish.

Paddle Steamer.—On March 5th a steam ferry was launched at the shipyard of Messrs. Burmeister and Wain, Limited, Copenhagen. She was built on account of the Danish State Railways, and is intended for the great Belt traffic. The dimensions are:—Length, 250 ft.; breadth, 58 ft.; and depth, 16¾ ft. She is a paddle steamer, and the engines, which were also made by the above establishment, have a nominal power of 300 H.P. There are four boilers, and there are to be two lines of rails.

TRIAL TRIPS.

El Mounsef.—On February 24th the steam yacht *El Mounsef*, recently built and engined by Messrs. Ross & Duncan, Whitefield Works, Govan, for the Egyptian Government's quarantine service, had her trial trip on the Clyde. She measures over all 59 ft. 8 in., and is fitted with a pair of compound surface-condensing engines, having cylinders of 10 in. and 20 in. in diameter, respectively, with piston stroke of 14 in., and Bremme's patent valve gear; she is fitted with Duncan's patent propeller, and a steel double-furnace multitubular boiler having a working pressure of 100 lbs. per square inch. The trial was made under very unfavourable circumstances, as regards weather, but notwithstanding that fact, over a mean of four runs, she made a speed of 10·4 knots per hour, which was in excess of the guarantee, and gave great satisfaction. The engines of this vessel are the fourth set supplied to the Egyptian Government.

Hare.—On February 25th the Royal Mail steamship *Hare*, lately built by Messrs. Barclay, Curle & Co., Whiteinch, to the order of Messrs. G. & J. Burns, Glasgow, ran her official speed trials on the Firth of Clyde. Intended for a daylight service between the Clyde and Belfast, which is to be commenced early in the ensuing summer, the *Hare* is a vessel of 771 tons gross register, and is fitted with triple-expansion engines. Her speed, according to specification, was guaranteed by the builders to be maintained by the Cloch Lighthouse round Ailsa Craig and back to the Cloch, a distance of about 88 miles—an unusually severe test of a vessel's steaming capabilities, which might well be accepted as a reliable criterion of her effective power at sea. This course was duly covered at the specified speed, and in "running the lights," which is the ordinary method of ascertaining the speed of a vessel, the rate of 14½ knots was attained. The *Hare* is provided with an electric light installation on the latest approved principle, and the cabins and passenger accommodation generally are furnished in the most elegant and comfortable manner.

Midge.—On March 1st the steam tug *Midge*, built by Messrs. Forrest & Son, of Limehouse and Millwall, for the Crown Agents for the Colonies, went on her official trial trip at Long Reach, Greenhithe. The vessel is built of teak and is of the following dimensions:—Length, 48 ft.; breadth, 10 ft.; depth, 5 ft. The engines are of the high-pressure type; cylinders, 8 in. diameter with a stroke of 10 in. Marine multitubular boiler. The mean speed attained on the trial trip was 9½ miles per hour. Messrs. Matthews & Wingate, who represented Sir John Goode, expressed themselves highly satisfied with the speed, seaworthiness, and the high quality of the workmanship and material throughout the vessel. The *Midge* is intended for towing purposes at Castries Harbour, St. Lucia.

Duitschland.—On March 2nd the trial trip of the *Duitschland* took place. She is one of the three sister vessels which have been built by the Fairfield Shipbuilding & Engineering Co. (Limited) to the order of the Zeeland Steamship Co., for service during the day between Queenborough and Flushing in connection with the London Chatham and Dover Railway and the Netherland State Railway. The other vessels are the *Engeland*, which will be completed within the next few weeks, and the *Nederland*, which was recently launched. His Royal Highness Prince Henry of the Netherlands is the promoter of this line of steamers. At present a night service is supplied by four vessels belonging to the com-

pany, and the day service will be commenced in June. These are the largest Royal Mail steamers crossing the Channel, and by the Queenborough and Flushing route can be made the shortest passage between London and Berlin, Hamburg, Vienna, &c. All the steamers are of one size, and offer the same comfort to the public, each being fitted with drawing-room, ladies' saloon, smoking-rooms, and comfortable roomy cabins. The *Duitschland* is a paddle-steamer, built of steel, and of the following dimensions:—Length, 286 ft.; breadth moulding, 35 ft. 3 in.; depth moulding to upper deck, 23 ft. 3 in. Her gross tonnage is about 1,500, and she is constructed to meet the highest requirements of Lloyd's for Channel service. On the upper deck aft is a large house containing a spacious deck saloon, smoking-room, and six state-rooms, two of which are fitted up in a superior style for the use of distinguished travellers, and can be used *en suite* if desired. From this house entrance is had to the lower saloons. The height 'tween decks on the after part of the ship is unusually high, being 9 ft. Immediately below the deck saloon is situated the dining saloon, and light and air for both are obtained through a large oval well. Aft is the ladies' saloon, and on each side of the staircase spacious lavatories are provided. These rooms and the smoking-room are all finished in dark wood with light panelling, and the ceilings are white with gilt ornamentation. The deck saloon is a well-lighted, cheerful apartment, a special feature of the decoration being numerous fine paintings by Dutch artists. An awning deck, extending from the after cargo-hatch to within a few feet of the stern, affords a promenade for passengers. Between the paddle-boxes is a bridge-deck, with house for captain, and on the upper deck forward is a small deckhouse containing rooms for purser and pilot, as also stairway to second-class accommodation, which consists of a large saloon extending right across the ship, with a ladies' room, &c., adjoining. Mail-room and officers' state-room are abaft of the second-class saloons, and the crew, firemen, &c., are berthed at the extreme fore-end of the vessel. Windlasses, winches, steering-gear, and two capstans are all worked by steam, and are of the most improved description. The steamer has been fitted throughout with the electric light (by Mr. J. F. D. Andrews, of the Woodside Electric Works, Glasgow), as also electric bells, patent boat-lowering gear, concussion fire-engines, and every appliance for the comfort and safety of the passengers. The vessel is driven by a pair of compound oscillating engines, with surface condenser. The cylinders are two in number, the high-pressure one being 60 in., and the low-pressure 104 in. in diameter, and both are adapted for a stroke of 7 ft. The paddle and intermediate shaft are of steel, and the paddle-wheels have steel floats on the feathering principle. Steam is supplied to the engines by four single-ended cylindrical tubular boilers, all the plates of which are of steel. The total heating surface is about 8,000 square feet, and the working pressure 80 lbs. per square inch. The *Duitschland* left the Tail of the Bank, and after steaming round the Cumbraes ran the measured mile at Skelmorlie. A number of progressive trials were made, and the last two gave an average speed of 18·1 knots, with 36 revolutions of the engine, a result which was considered very satisfactory.

Hondo.—On March 5th the *Hondo* (s), which was built by Messrs. Robert Duncan & Company, Port Glasgow, to the order of the Honduras and Central American Steamship Company (Limited), went down the river on her trial trip. The *Hondo* is an awning deck steel screw steamer, and her dimensions are:—Length, 235 ft.; breadth 35 ft.; and depth of hold, 26 ft. 9 in., with a gross tonnage of 1,615 tons. She had been built to the highest class at Lloyd's and is intended for the company's passenger and fruit traffic between Central America and New York. The engines are of the triple-expansion type, and have been supplied by Messrs. Muir & Houston, Harbour Engine Works, Glasgow. The *Hondo* is fitted with accomodation for 40 passengers. The vessel steamed down to Skelmorlie and made several runs to the measured mile. During the runs the engines developed about 1,900 H.P., and the vessel attained a mean speed of 14½ knots, which is one knot in excess of the guaranteed contract speed. The *Hondo* is the second steamer which Messrs. Duncan & Co. have built for the Honduras and Central American Company, the other being the screw steamer *Aguan*, which is now on her way out to America.

Camperdown.—On March 7th the new barbette armour-clad *Camperdown* went out to Spithead for a preliminary natural trial of her engines. The ship was light, drawing only 22½ ft. forward and 24½ ft. aft, but she will at the subsequent trials be brought down in the water to within a foot of her load-line by filling her double bottom. The contract was for 7,500 horses under natural draught, but from the first she exceeded this, the first diagrams giving 7,798·67, and the second 8,421·42, while the mean of two runs on the mile gave a speed of 16½ knots. The engines gave no trouble, and the absence of vibration was a noticeable feature of the trial.

Robert Harrowing.—On March 7th the new steel steamer, *Robert Harrowing*, built by Messrs. Joseph L. Thompson & Sons, of North Sands shipbuilding yard, and sold to Mr. Robert Harrowing, of Whitby, proceeded from the South Dock, Sunderland, for her official trial. The company included Mr. and Mrs. Harrowing, jun., Mr. Robert Thompson, Mr. H. Harper, and other visitors. The compasses having been adjusted, the vessel was run over the measured mile, the progressive trials being highly satisfactory; the greatest speed attained was 11 knots. The engines are of the triple-expansion type, the cylinders being 22, 37·5, and 60 in. respectively, with a stroke of 39 in., and two double-ended steel boilers, working at a pressure of 145 lbs. per square inch, built by Messrs. T. Richardson & Sons, Hartlepool. During the trial the engines and deck machinery worked with the utmost satisfaction. The engines had been under the supervision of Mr. William Taylor, superintendent engineer of the owner. After a very satisfactory trial the vessel left, under the command of Captain F. Dixon, for Genoa.

Auckland.—On March 8th the s.s. *Auckland*, constructed by Earle's Shipbuilding and Engineering Company, Limited, Hull, for the Humber Conservancy Commissioners, for salvage and towing purposes, was taken on her trial trip. The vessel is built of steel to the 100 A1 class, her dimensions being 132 ft. and 22 ft. and 11 ft. 6 in., and her scantlings are considerably in excess of rule. She has a flush deck of chequered plate, and a strong wood belting is carried round for chafing. Large catheads are built into the ship at each end for taking heavy lifts, and she has other efficient appliances, including a steel foremast of large diameter and two powerful steam winches. A horizontal pump fitted as a fire engine is fixed in the engine room with deck connections, and she has also two Drysdale's 12 in. centrifugal pumps and a portable one of smaller size for salvage purposes. The engines are compound 18 in. and 36 in. diameter and 21 in. stroke, supplied with steam from a large steel boiler made in accordance with the Board of Trade rules for a working pressure of 90 lbs. per square inch. The run was made to the Newsand Light and back at an average speed of upwards of 10 knots, the engines working remarkably smoothly and indicating 370 H.P., which was considered highly satisfactory.

Carmarthenshire.—On March 8th the steamer *Carmarthenshire*, built by Messrs. C. S. Swan and Hunter, of Wallsend-on-Tyne, to the order of Messrs. D. J. Jenkins and Co., London, for their Japan and China trade, went on her official trial trip, and gave the greatest satisfaction. The principal dimensions of this last addition to the Shire Line fleet are:—Length, 340 ft.; breadth, 40 ft.; and depth moulded, 27 ft. 8 in. Her gross tonnage is 2,726, and she will have a deadweight capacity of 4,100 or 4,500 tons of tea. The *Carmarthenshire*, built under the inspection of the company's engineer and superintendent, Mr. C. E. Hudson, of London, is of steel throughout. She is in excess of Lloyd's rules for the 100 A1 class, is constructed on the cellular double bottom principle, with water ballast capacity all fore and aft, for 1,070 tons, and has specially arranged compartments for carrying camphor, oils, &c., at the same time as tea. The ventilation of the holds has been well thought out, the principle adopted being automatic exhaustion by means of the main funnel, and so arranged that it goes on irrespective of the weather, this being a matter of great importance in the eastern trade, and especially on the passage between Singapore and Suez during the south-west monsoon. Accommodation is provided for 30 first and six second-class passengers in the full poop. The *Carmarthenshire* meets all the Admiralty requirements for transport service, and will be furnished with a Board of Trade passenger and Lloyd's 100 A1 certificates. A special feature of this vessel is that she has been fitted throughout with electric installation, including a search light for making the passage of the Suez Canal at night time. There are six powerful compound steam winches for working the cargo, which are somewhat of a novelty, and, by the saving of coals they effect, will enable the electric light to be used without going to extra expense for fuel. The upper deck is of steel sheathed with teak wood, and the poop, bridge, and forecastle decks are of teak. There is a powerful steam windlass, and steam steering gear has been supplied by Messrs. Muir and Caldwell, of Glasgow. Otherwise the steamer, which is rigged as a three-masted schooner, is fitted with every modern appliance. The engines have been built by Messrs. R. & W. Hawthorn, Leslie and Company, of St. Peter's. They are on the triplex system, the

cylinders being 27, 43, and 70 in. in diameter, with a 45-in. stroke. They worked with the greatest smoothness on the trip, and the vessel on running over the measured mile in a southward direction, did the distance in 4 minutes 19½ seconds, this being equal to 14 knots an hour, the engines making 75 revolutions per minute. Returning towards the north, the vessel went over the distance again in the opposite direction, with the tide a little against her, and did the distance in 4 minutes 35 seconds, equivalent to 13½ knots an hour average speed, the engines making 76½ revolutions per minute. Both performances were considered very satisfactory, and were above the guaranteed speed of the vessel. It was a theme of general remark that the vibration from the engines was very slight. Steam is supplied from three boilers, containing 6,000 ft. of heating surface, and the engines developed 2,340 I.H.P. The *Carmarthenshire* proceeds to China, via Cardiff, in time for the new season teas.

Porpoise.—On March 8th the *Porpoise*, torpedo gunboat, built and engined by Messrs. Thomson, Glasgow, completed her engine trials at Portsmouth by a four hours' run under forced draught. This severe ordeal is generally very trying to vessels of her size. The *Porpoise* has proved highly successful, no mishap having occurred to retard the trial. With a mean pressure in the boilers of 124 lb. and 154 revolutions, the engines indicated 3,934 H.P., or upwards of 400 horses in excess of the contract, while the ship realized a speed of 17½ knots. The consumption of coal amounted to 2 lb. per horse per hour. When tried with natural draught the *Porpoise* developed 2,477½ H.P. and attained a speed of 16 knots. the consumption of fuel being the same as with closed stokeholes.

Glenshiel.—On March 9th the new screw-steamer *Glenshiel*, built and engined by the London and Glasgow Shipbuilding and Engineering Company (Limited) to the order of Messrs. M'Gregor, Gow & Co., for their well-known Glen Line of steamers, went down the Firth on her trial run. The *Glenshiel*, which has been specially constructed for the China trade, has a length of 370 ft.; breadth, 45 ft.; depth, 34 ft. 6 in.; and her gross tonnage, 3,460. She has been constructed under Lloyd's special survey for the 100 A1 class, in excess of their requirements, and also in accordance with the Admiralty requirements in respect of bulkheads, &c., for first-class transport service. As in the other specially-constructed steamers of the Glen Line. she has a poop. long bridge-house, and topgallant forecastle, with all the most suitable accommodation for comfort, convenience, and ventilation. The *Glenshiel* has two steel decks, with all the upper of teakwood, and the deckwork and fittings, when not of iron or steel, are of teak. Within the poop is the state-room accommodation for 26 first-class passengers, with captain's, doctor's, and other cabins, and amidships in the bridge-house accommodation is afforded for a number of second-class passengers. The saloon is tastefully and elegantly fitted up in polished wainscot, maple, and satinwood, with solid oak capitals and cornices and silver mountings, and on the polished hardwood panels all round are chaste hand paintings characteristic of the company and of the ship's name. The most careful attention has been paid to the ventilation in connection with the saloon and state rooms, and this matter, which is of essential importance, has always been a distinguishing feature of the Glen Line. In addition to the attention paid to passenger accommodation, that of the cargo has not been overlooked, and the hold and 'tween decks have been carefully safeguarded, whereby the staple homeward cargo of tea will be kept fresh and uninjured. Throughout the vessel the most efficient and powerful appliances of every kind have been provided for handling and safety at sea, and for rapid loading and unloading of cargo. Indeed, on the part of builders and owners alike, no expense has been spared to render the *Glenshiel* in every respect one of the most complete steamers on the ocean, and in the opinion of the most experienced, all that has been aimed at has been obtained. The machinery of the vessel consists of a set of triple-expansion engines, with cylinders 34, 53, and 87 in. diameter, and a stroke of 54 in. There are three double-ended cylindrical steel boilers, fitted up with Fox's patent furnaces, working up to a pressure of 140 lbs. The speed expected was from 13 to 13½ knots, but the run from the Cloch to the Cumbrae, Light gave 14·6 knots, a most satisfactory result, especially when it is noted that the vessel had about 1,800 tons of cargo on board. One special feature of the engines is the adaptation of Joy's patent valve gear, which dispenses with the more cumbersome and less effective link motion and eccentrics for working the valves. The machinery throughout has been designed and constructed in the builders' high-class style, and worked with great smoothness and regularity. The *Glenshiel* has been fitted throughout with the electric light. She is the seventeenth steamer built by the London and Glasgow for the same owners, and Captain Duke is in command. On the run up from the Garroch Heads dinner was served in the saloon by Mr. John Forrester, Gordon Street, Glasgow. Mr. G. W. Clark, chairman of the London and Glasgow Engineering & Shipbuilding Company, presided, and Mr. Thomas Reid, Kilmardinny, was croupier. Amongst those those who sat down were:—Mr. Leonard Gow, sen., of Messrs. M'Gregor, Gow & Co.; Mr. John Darling, Mr. D. Kinghorn, general manager of the London and Glasgow Engineering and Shipbuilding Company; Captain Hutton, shore captain of Glen Line; Captain Hardie, of the Clutha Line; Mr. J. B. Murray, Captain Tessier, of the Bureau Veritas; Mr. Archibald Russel, jun., Bothwell; Mr. Leonard Gow, jun., &c. Mr. Gow, in proposing the toast of "The Builders," and after referring to the success of the trial, said the Glen Line had some vessels which had been running for fourteen years with the old boilers still in them, and the old machinery working away as honestly and faithfully almost as on the day they were put in. He was only sorry that the builders, like other firms on the Clyde, were at the present time doing very little. However, he hoped that they would soon hear that the London and Glasgow had secured another contract. The *Glenshiel* before proceeding to London to complete her loading took on board, at Greenock, 200 tons of charcoal.

Lavinia.—On March 9th the new iron screw-steamer *Lavinia* made a very successful trial trip in the Flensburg Bay. This vessel is the third which the Flensburg Shipbuilding Company have built for the new Hamburg Pacific Line. The dimensions are the same as the two sister ships *Cordelia* and *Bianca*. Length, 270 ft.; breadth, 35 ft.; depth of hold, 26 ft. 3½ in. The cabin arrangements for passengers and the saloon, which is in an elegant and tasteful style, are placed in the after part of the deckhouse. The engines are triple-expansion, also built by the Flensburg Shipbuilding Company, and the same as on *Cordelia* and *Bianca*, worked to entire satisfaction. After the measured distance was run, a steamer took the partakers back to Flensburg. and *Lavinia* proceeded to Hamburg, where she will load a full cargo for South America.

Era.—On March 10th the s.s. *Era*, designed by Sir E. J. Reed, and built and engined by Palmer's Shipbuilding and Iron Company, was tried at the measured mile off the Tyne. The principal dimensions of the vessel are:—Length between perpendiculars, 271 ft.; moulded breadth, 37 ft.; depth of hold to main deck, 15 ft. 6 in.; the vessel being built on spar deck rules. She has been built of steel to the highest class at Lloyd's, and is capable of carrying 2,000 tons deadweight of oil below main deck. The pumping arrangements for delivering oil are very complete and fitted on main deck, the Worthington Plant being capable of delivering 1,000 gallons per minute. The engines are triple-compound, with cylinders 21 in., 34 in., and 57 in. in diameter, with 39 in. stroke, steam being supplied at 150 lbs. by two single-ended boilers 12 ft. 6 in. diameter and 10 ft. 6 in. long, fitted with Foxe's furnaces. The vessel is also fitted direct steam windlass and donkey boiler, both of Clarke, Chapman & Parson's manufacture. There is also a complete installation of electric light, with Holmes' dynamo, driven by a Tangyne vertical engine placed in the engine-room. On the measured mile, on a mean of four runs, the vessel averaged 10·89 knots, with 73 revolutions and 26 in. vacuum, developing over 1,100 I.H.P. on a load draft of 17 ft. 5 in. mean, and there being a strong E.N.E. wind and heavy swell. Mr. P. Hall was present on behalf of the builders, and the trial was conducted by Sir Edward Reed's officers, Mr. John Hudson and Mr. Robert Baggallay.

Forth.—On March 19th this vessel, built by Messrs. A. & J. Inglis, Pointhouse, for the Canon Shipping Company, completed a series of speed trials of almost unexampled extent, having made no fewer than 36 runs on the measured mile, and finally a trip from Cloch round Ailsa Craig and back. The result is gratifying alike to builders and owners, the mean speed with a deadweight cargo of 390 tons on board, having been 15·18 knots per hour. The *Forth* and her consort, the *Thames*, will shortly leave Glasgow to take up the new service between Grangemouth and London, for which their speed and excellent arrangements for passengers render them so well adapted.

Jubilee.—On March 16th the trial trip took place of the new steam cutter *Jubilee*, built by Messrs. W. B. Thompson and Co., of Dundee, for the Great Northern Steam Shipping Company. The *Jubilee* is built of steel, and schooner-rigged, with a length of 130 ft. and a breadth of 21 ft. Her net tonnage is

56 tons, and she is registered 90 A1 at Lloyd's. The motive power is supplied by two inverted compound surface condensing engines, of 66 N.H.P., sufficient, it is expected, to drive the vessel at a speed of 12 knots an hour. On the measured mile at Dundee the *Jubilee* attained an average speed of 10½ knots per hour, and this rate was maintained during nearly the whole of the run. She is fitted with patent Messenger windlass by Emerson, Walker and Thompson Brothers, Limited.

Plymouth.—On March 16th the finely modelled screw-steamer, *Plymouth*, built to the order of the Plymouth, Channel Islands, and Brittany Steamship Company, Limited, by the Sunderland Shipbuilding Company, Limited, went out to sea on her trial trip. The dimensions of the vessel are:—Length, 150 ft.; breadth, 22 ft.; depth of hold, 11 ft.; classed 100 A1 Lloyd's special survey. The engines are 20 in. and 40 in. by 24 in. stroke, having one large steel boiler working at a pressure of 100 lbs. per square inch, supplied by Mr. J. Dickinson, of Sunderland. The vessel is specially designed for the Channel passenger trade, and has a large and spacious open saloon for first-class gentlemen passengers aft, tastefully upholstered in crimson velvet, the wood work being oak and maple, relieved with gold. There is also a large ladies' saloon adjoining, fitted in a similar manner, but upholstered in blue velvet. The second-class passengers are berthed forward in a large open saloon, upholstered in railway cloth, and a long open bridge is fitted as a shelter for deck passengers. The lines of the steamer are exceeding fine, and the best runs over the mile gave a speed of 14¾ knots; after this she was tried between Sunderland Lights, and Tynemouth Light, both north and south, which gave a mean speed of 13 knots per hour. The times and bearings were accurately taken by Capt. Collings, on behalf of the owners, and he expressed himself as highly satisfied with the result, the guaranteed speed being only 12 knots per hour. Great credit is due to the engine builders, as during the whole of the respective runs the engines worked with a degree of smoothness which was highly creditable, and not the slightest hitch of any kind occurred.

Haitan.—On March 19th the s.s. *Haitan*, which has been built by Messrs. Raylton, Dixon & Co. to the order of John S. Lapraik, Esq., for the Douglas Steamship Company, Limited, of Hong Kong, left Middlesbro' Dock, on her trial trip, which was in every way most satisfactory to her owners and builders. Noted as her builders are for a high class of passenger steamers, this vessel excels all they have previously built, both in design and perfection of workmanship, and is admitted by many who know her trade, to be the finest steamer for the China coast, where already so many luxurious boats are employed. She is built of steel on very fine lines, being intended for good speed, and of the following dimensions:—Length overall, 284 ft.; breadth, 32 ft.; depth of hold, 24 ft. Constructed on the three-deck rule, she has a clear upper deck of teak, with deck-house aft, bridge, and forecastle. Double bottom for water ballast on cellular system throughout. In the deck-house aft, which is built of teak, is a most elegant saloon, panelled in marbles, white-veined, rouge and sienna, cushioned in red morocco, and funished with rich velvet cushions and handsome silver lamps, lofty and well ventilated, and hung with blue silk punkahs for the tropical climate she will trade in. Each of the state rooms which are entered by a passage from the after end of the saloon, is most luxuriously fitted, having only two berths in each, the very latest form of patent lavatory, silver-plated lamps and fittings, morocco cushions and handsome carpets. Bath rooms, with tiled floors and walls. Indeed, in every respect she is fitted more like a yacht than even the best mail steamers. Above this deck-house, and raised a few inches clear of its top for purposes of ventilation, is a light shade deck, carried out the full breadth of the ship on very light elegant frames. On this deck is placed a most luxurious smoking saloon, and this part of the ship would be found a very favourite lounge under its double awnings in a hot climate. The captain's room in the deck-house, and the officers' and first-class passengers' rooms under the bridge, are fitted equal in every respect to those described. The whole of the 'tween decks from end to end is fitted for passengers. The after end for 120 second-class in most comfortable and airy cabins, and the rest in portable berths for the accommodation of native passengers, of whom she will often carry 800 to 900. All the hatchways are teak grated on both decks, and abundant ventilation provided, while special steam cooking arrangements for rice boiling are provided under the bridge for this large number. She is specially fitted and ventilated for carrying tea cargoes, of which she can load about 3,000 tons, and has large cargo ports in the 'tween decks, as well as gangways on deck for convenience of loading. Her steam winches are compound; she has steam windlass and steam steering gear. Her main rail and bridge rail are covered with brass, the accommodation ladders, all deck ladders, and hatchways have brass railings, and in all these respects is like a yacht. The engines with which she is fitted are of the latest triple-expansion three cylinder type, capable of developing 2,000 H.P., and supplied with forced draught to the boilers worked by Chandler's patent engine. The engines worked perfectly on the trial trip, and produced a speed of over 14½ knots average. A party of her owners and friends on board expressed the greatest satisfaction with the ship and engines, for which they gave the fullest credit to her builders, and also to Mr. George Walker, naval architect, of London, under whose superintendence she has been built. On leaving Tees Bay the *Haitan* steamed for Antwerp, where she will load for Hong Kong direct.

Rondine.—On March 19th the iron steam yacht *Rondine*, 625 tons y.m., built for Prince Sirignano of Naples, by Messrs. Ramage & Ferguson, of Leith, went out on her official trial trip on the Firth of Forth under favourable circumstances. The *Rondine* proceeded at an easy speed down the Firth till Gullam Bay was reached, where with full steam she was run on the measured mile, with the result of showing that a speed of 13·487 knots per hour was attained with the engines indicating 876 I.H.P. Thereafter a run was made with the patent log out for a fixed time, and the yacht proved to be then going slightly faster than on the mile. Afterwards the cruise was continued as far as the Ban Rock and Tantallon Castle, and then back to Leith, which was reached in the evening. The *Rondine* is 193 ft. long by 26 ft. 6 in. broad, and 16 ft. 6 in. depth moulded, the engines being triple-expansion of a new design (specially introduced by the builders for yachts), with three cylinders 19 in., 31 in., and 49 in. diameter by 33 in. stroke, supplied with steam at 150 lbs. by two steel boilers. The cabins are principally in the fore part of the yacht, where the saloon and suites of apartments for the Prince and Princess are situated. A large deck-house contains drawing-room, smoking-room, service-room, and kitchen, while the bridge formed above makes a promenade deck. The rig is that of a three-mast schooner with yards on the foremast. An Italian crew has been sent from Naples to take the *Rondine* out to Italy.

Pholas.—The twin screw hopper dredger *Pholas*, built for the Bombay Port Trust by Messrs. David J. Dunlop & Co., Port Glasgow, successfully completed her trials of dredging and speed, and is now in the builders' hands being prepared for the voyage to Bombay. The *Pholas* is 155 ft. long, 31 ft. beam, and 10 ft. depth moulded, built of steel, and divided into eight watertight compartments; the hoppers have a capacity of 10,000 cubic ft., and the hull a displacement of 500 tons for carrying dredged materials. The propelling machinery consists of two pairs of compound surface-condensing engines of 350 I.H.P., which gave a speed of over eight knots to the vessel on trial, with a deadweight capacity of 500 tons of spoil on board. The dredging plant has been supplied by Messrs. Stothert & Pitt, engineers, Bath, and consists of two cranes with their buckets, placed fore and aft of the hopper, and in the centre of the vessel. They are of the type known as horizontal cranes, having horizontal cylinders, and with centre pin instead of crane post. The cranes are nominally of 10 tons power, and equal to lifting with the single chain freely and easily a load of 6 tons. They are fitted with single and double purchase lifting gear, slewing or turning gear, this motion being given by patent double friction clutches, capable of turning the crane in either direction when lifting or lowering, without stopping or reversing the engines. Derrick gear to the jib, the jibs being of a bent trussed form to give greater clearance below the jib, and of sufficient length to give a maximum radius of 25 ft., and a minimum radius of 16 ft. The derrick gear is also given by friction clutches, and this motion can be operated at the same time as any of the other motions. There are two steam cylinders to each crane of 9 in. diameter by 12 in. stroke, fitted with the ordinary link-reversing motion. The steam and exhaust pipes are both carried through the centre pin of the crane, the exhaust being led back into the surface condenser of the main engines of the vessel. The whole of the levers for working the various motions of the crane are all worked in one direction, and are all brought close together on one side of the crane, thus making the crane extremely handy for driving. The design of the cranes is such that the centre of gravity, with or without the load, is practically always within the roller path, thereby reducing to a minimum the strain on the deck of the vessel and the foundations of the crane, and the last on the vessel when dredging over the side. The roller path and slewing ring is not attached rigidly to the bed plate, but is simply held by the weight and friction of the

superstructure of the crane. If any undue shocks from bad driving or other causes be given to this roller path and slewing ring, it will partly slip or turn round on its seating instead of breaking the teeth, until the crane be gradually started into motion or arrested; this movable ring having the further advantage of becoming worn equally throughout its entire circumference, instead of wearing down in one place. These cranes are each fitted with a nominal 1½ yard size Wild's patent dredger bucket, the peculiarity of these buckets being that the whole cycle of operations of opening, closing, filling, and discharging, are performed by the single lifting chain of the crane. At the trial of these cranes and patent buckets, although the buckets were only of a nominal 1½ yard capacity, it was found that in free working stuff they brought up from 3 to 3½ yards of stuff, and this operation was being performed by a driver quite strange to the work, at the rate of 40 lifts per hour. An experienced man would readily make from 50 to 60 lifts per hour. The advantages of this system of dredging are, amongst others, that only light moorings are required to enable dredging operations to be carried out in either hard or soft material, while the buckets can dredge close up to quay walls. In soft material the two cranes would fill the hopper in about two hours. The *Pholas* is also fitted with a very powerful fire engine and salvage pump, supplied by Messrs. Shand, Mason & Co., of London; it is a double horizontal engine, the steam cylinders being of large diameter to allow of being worked by low pressure steam in case the fires under the boilers are banked up. In each engine from the piston of steam cylinder two piston rods are connected to the ram of a double-acting bucket and plunger pump, and from a jaw at the bottom of this ram a connecting rod returns to the crank pin of a double-throw shaft; eccentrics keyed on each end of this shaft work the slide valves. A ratchet and paul with long lever enables the engine to be turned when standing. A relief valve is fitted on the pump head to prevent over-pressure in case of starting the engine with outlets closed or the hose kinked. Under ordinary circumstances the pump receives its supply of water from a sea box, but a flexible pipe can be connected by means of which sunken or water-logged vessels can be pumped out. There are four deliveries to the engine, and a trial which took place on board this vessel in the presence of Mr. McConnochie, the engineer to the Surrey Commercial Docks, and Messrs. Dunlop, the builders of the vessel, two 1 in. jets, and two 1¼ in. jets were thrown at the same time under a water pressure of 160 lbs., and a single jet 2⅛ in. in diameter was worked at a similar pressure, the horizontal distance reached being over 300 ft. These engines have been supplied to various Dock Companies for use as salvage pumps and fire engines, and no better means can be devised for protecting dock property than an engine of this description fitted on board a tug boat in which the steam is always up. In London these engines have been supplied to the Albert Docks, London and St. Katherine Docks, Surrey Commercial Docks, East and West India Docks, and Tilbury Docks, &c., &c. The contract has been carried out under the superintendence of James A. McConnochie, Esq., C.E., London. The steamer sails for Bombay under the command of Captain Hall.

INSTITUTION OF MECHANICAL ENGINEERS.—His Royal Highness the Duke of Cambridge will honour the Institution of Mechanical Engineers, by dining with them, on the evening of Tuesday the 17th of May. The Spring Meeting of the Institution will take place on Monday the 16th and Tuesday the 17th of May, under the presidency of E. H. Carbutt, Esq.

MESSRS. CROSBY, LOCKWOOD AND CO. announce for immediate publication an important new book by the author of "The Works' Manager's Handbook," entitled "The Pratical Engineer's Handbook," being a treatise on modern engines and boilers, marine, locomotive and stationary, containing a large collection of rules and practical data relating to recent practice in designing and constructing all kinds of engines, boilers, and other engineering work, the whole constituting a comprehensive key to the Board of Trade and other examinations in modern mechanical engineering, by Walter S. Hutton, author of "The Works' Manager's Handbook for Engineers," &c., with upwards of 370 illustrations, medium 8vo., about 500 pages. The same firm also announce "A Pocket Glossary of Technical Terms in French-English and English-French," suitable for the building, engineering and nautical professions, with a large number of tables of French and English weights, measures, and calculations, by J. J. Fletcher, engineer and surveyor; waistcoat pocket size.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—ED. M. E.]

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—The very excellent letters from your correspondents, "Self-Help," "Excelsior," and "Experience," which appeared in your last issue regarding the position of Marine Engineers, could not have been written more opportunely, apppearing simultaneously as they did with your own kind intimation that arrangements were nearly completed for the formation of a Marine Engineers' Union.

The Union having now been instituted, as will be seen from a report elsewhere in your columns, it will probably occur to your correspondents to enquire in how far the Union promises to meet their views, and as this is a matter of deep and universal interest to sea-going engineers, if you will kindly grant me space I will endeavour to answer these enquiries as clearly and concisely as possible. "Self-Help" will I am sure be pleased to find that writing and talking have now been left off, that real and earnest work has taken their place, and that as soon as it is possible to do so the efforts already made by him and his brethren in Newport will be followed up and supported by a branch of the Union being opened in their midst. The proposal to ask the Amalgamated to form a sea-going department having been duly discussed, the committee, who are nearly all members of that society considered that it had already enough on its hands, and that a separate union, composed of sea-going men only, devoted entirely to their interests, and managed exclusively by themselves would be more sympathetic and more efficient in its action than any mere department of another large society; and now "Self-Help," as to not being able "to form a society all at once by ourselves," you see it is already done, and being founded upon sound principles, and under the care of earnest, experienced, and resolute men, it has started into being with all the life and vigour of full grown manhood. The hours of labour, I may tell you, form one of the most important subjects of improvement to be dealt with by the Union, and your views thereupon will be kept prominently on view.

"Excelsior" will find that his views have been all embodied in the programme of the Union with but very slight modification. It is intended to procure an emendation of the Merchant Shipping Acts, so that ultimately no engineer shall be allowed to take charge of a watch without at least a third class certificate, and one of the objects of the Union embraces the extension and encouragement of education amongst engineers, whereby the standard of examinations might gradually be raised, and members of the Union would in time be regarded by the world at large as *a body of educated, well informed, and well conducted men*, and as such they would be awarded a much higher social status than they can at present command. There is no good reason, "Excelsior," why the Marine Engineers' Union should not be as powerful, as wealthy, and as much respected as the Institute of Civil Engineers, for the marine branch is quite equal to it in the quality of its workmanship, in its usefulness, and in the talent and character of its members; but there has hitherto been no unity among them, and no earnest attempt to bring it about. This has now been provided, not as a mere impulsive and imperfect scheme, but as the result of much care and study expended upon designing a scheme that should avoid all the defects and errors that have contributed towards the failure of previous schemes, and combine in one harmonious whole, those varied elements which experience has shown to be essential to the success and longevity of similar organizations. Thus, and thus only can be realized your desire of *one grand Universal Association of Sea-going Engineers*, and when you are informed that there are already hundreds of engineers waiting for the issue of application forms in this district alone, you may feel assured that your hopes have now every prospect of being speedily realized.

The views of "Experience" as to it being necessary to have a resident secretary and permament staff are quite in unison with

those of the committee who initiated this movement, but his fears as to not being able to obtain such without salaries and great expense have fortunately turned out to be groundless, as the Union has already secured for its permanent officials certain retired and other sea-going engineers who have cheerfully undertaken the duties, but *only* upon condition that there would no salary of any kind attached to their respective offices. This speaks for itself and shows the kind of men who have taken the matter up, and this voluntary action upon their part has led to the committee making it a standing rule *that no office-bearer shall be entitled to or be paid any salary in respect of his office*. This will make so much difference in the expenditure, that the subscription has been fixed at the very moderate sum of twenty shillings per annum, or five shillings per quarter if more convenient for members.

If I were not trespassing so far upon your space I might go on writing about the objects, the operations, and advantages of the Union for a very long time, but as anyone may have, post free by applying to me, a circular setting these forth in detail. I must now conclude with thanks for your courtesy.

THE HONORARY CHIEF SECRETARY,
Marine Engineers' Union.

Chief Offices:—91, Minories, London, E.

To the Editor of THE MARINE ENGINEER.

SIR,—Being a constant reader of your valuable paper, and having read "Excelsior's" correspondence of last month's number, I am rather inclined to think that "Excelsior" has a very high opinion of himself and a very poor opinion of his fellow practical marine engineers. As regards the Board of Trade Examinations, there are three things mentioned in his letter, namely, Inorganic Chemistry, Hydrostatics, Hydrodynamics. &c. What do we want with those three subjects at all? Of what use are they to the class of marine engineer that is required at the present day? What is required is more practical engineers and less theoretical engineers. I am sorry to say there are too many of that class, and good practical marine engineers left out in the cold. I think "Excelsior" wants to be a C.E. instead of a practical marine engineer; and, supposing that his letter had been the means of influencing the Board of Trade to raise the standard of the examinations up to his desire, what encouragement is there for a man to coach himself up to that standard at the rate of wages he does get at the present time? and as for being well-info med and well-conducted, I am sure there are in our midst as well-conducted and enlightened men as "Excelsior," and are quite satisfied with the present standard of the Board of Trade Examinations. If "Excelsior" has been one of these fortunate engineers to have had a college education, I think there is very poor credit to him that he has not been able to have turned it to some better account than going to sea and turning round and criticising his less fortunate uneducated engineers under him. I think if "Excelsior" does his duty to the machinery under his charge with only two engineers in the engine-room, he will find he will not have any time to study Inorganic Chemistry, Hydrostatics, Hydrodynamics, &c. And even in that class of boat he will find some very well-conducted and enlightened men, as well as in some of the big liners where there are six and seven of them, in which, I presume, he is in connection with. "Excelsior" is right by saying criticism is one thing, and any offer of improvement is better; if "Excelsior" is dissatisfied with the present examinations, let him enter the Naval Competitive Examinations. He may get his high notions eased down a little.

Secondly.—As to the Enquiry column, which no doubt will be of very great use to the poor uneducated practical engineer, but I think if "Excelsior" would undertake the post of answering the enquiry column himself it would be more befitting him than going to sea, without putting any more unnecessary strain upon our worthy editor of this good and useful paper. I am afraid "Excelsior" is not aware of the numerous duties that our worthy editor has in hands without adding any enquiry columns. I also agree with "Excelsior's" idea of practical marine engineers uniting, but there are very many engineers I know—thorough good practical men, and men who belong to the Amalgamated Society of Engineers and Steam Engine Makers' Society—who in these severe and trying times could not afford to pay a subscription of five pounds to commence with. If a society is to be formed it must be within the reach of all practical marine engineers, and not to only a few who are fortunate have a banking account to their backs. As it is a question that affects us all, I think "Onward's" idea a very practicable one; even if the subscriptions be one shilling per week from every member, in the course of a year or two there would be a respectable balance in hand, but we should have to have engineers that are permanently ashore to officer the society for us, and it must be a universal society, with branches in all seaports in the United Kingdom. I for one would be very glad to see such a society formed, and would (with several more I know) join, and would do my utmost when ashore in developing the scheme, and if circulars be printed would gladly distribute them amongst the practical uneducated engineers, and would not be afraid of the resulting of a strong branch amongst us. I am very pleased to s e that "Excelsior" is not above acknowledging trades-unionism. There is nothing whatever to be ashamed in it. There are plenty who would be proud to join such an association was there one in existence. It is high time we were up and helping ourselves. Hoping I have not trespassed too much upon your valuable space, I remain, sir, your truly,

AN UNEDUCATED ENGINEER.

SOUTH SHIELDS, *March 15th*, 1887.

PRESSURE IN THE WASTE STEAM PIPE OF A SAFETY VALVE.

To the Editor of the MARINE ENGINEER.

SIR,—I have taken the liberty to write to you about a question upon which a friend and I disagree. Could you let me know what pressure would be in the waste steam pipe of a safety valve, diameter of pipe, 6 in.; height, 20 ft., and pressure per square inch on valve, 160 lbs. The results we get are different, so we would like to know who is right. Your truly,

JAMES BROWN,
Chief Engineer.

GLASGOW, *March* 17th.

[As the waste pipe of the safety valve is open to the atmosphere, there is practically no internal pressure in it at all. If, however, the steam is escaping in large volume, there might be a small pressure, say, perhaps, 1 lb. per square inch, developed by the atmosphere resisting the rush of the steam. After the steam from the boiler has passed the safety valve, it is practically at atmospheric pressure.—ED. M. E.]

TRIPLE-EXPANSION ENGINES.

To the Editor of THE MARINE ENGINEER.

SIR,—I should feel much obliged, and the information would be useful to others, if Mr. J. Williams would be so good as to give the rules, and the method of arriving at the figures given in his table in your Journal for March, page 408. Yours truly,

March 17th, 1887. ARTHUR COLE.

THE TAX ON BRAINS.

To the Editor of THE MARINE ENGINEER.

SIR,—As there are still more recommendations from the Board of Trade Committee on the Patent Office to alter and *amend* the Patent Act of 1883, it may be necessary to call the attention of those of your readers who exert the power of their brains for the public weal, and neglect their own interests, to these "recommendations" and so-called "amendments." When the Act, in passing, was before a committee of the House of Commons—a grand committee, I believe—and Mr. Henderson, of Glasgow, proposed that the present Patent fees should be modified, the then President of the Board of Trade, Mr. Chamberlain, was reported to have said, in opposition to any modification, that "they must have their pound of flesh." This seems to have been taken as the key-note by all his followers, if not by increasing the fees, by lessening the duties of the officials in the Patent Office, more especially those of the examiners. When her Most Gracious Majesty grants any one of her subjects a patent, she warns all her other subjects "within our United Kingdom of Great Britian and Ireland, and the Isle of Man, that they do not at any time during the continuance of the said term of fourteen years, either directly or indirectly make use of or put in practice the said invention, nor any part of the same, nor in anywise *imitate* the same, nor make or cause to be made any addition thereto or subtraction therefrom." Now, sir, all your readers know how far this promise is fulfilled. But this is not the greatest danger to inventors at the present time. There is danger that the language of common sense in drawing up a specification for a patent does not agree with the interests of other Shylocks, and that more pounds of flesh will be required from inventors, although it is promised. "And, lastly, we do by these presents for us, our heirs and successors, grant unto the said patentee that these our letters patent shall be construed in the most beneficial sense for

the advantage of the said patentee." Here there is not one word of "technical legal phraseology," but plain English. When we consider that, unlike that of the first Shylock, these pounds of flesh are not cut from "nearest to the heart," but from the brain, the tax in time will affect the vitality of the inventors of this country, however plentifully they may be supplied with brains. Yours respectfully,

PROPELLER.

STEAM YACHT "SAREEA."

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—As there seems to be some misunderstanding concerning this vessel, we may state that the hull department was executed for us by Mr. W. S. Cumming, under our personal supervision.

In accordance with the wishes of our customers, the subsequent yacht, *El Mounsef*, for the same Government, was built by us in our own yard here. The machinery of the latter vessel is exactly duplicate of the *Sareea's*, and we are obliged by your notice of its special features. Sincerely yours,

GLASGOW, 14*th March*, 1887. ROSS & DUNCAN.

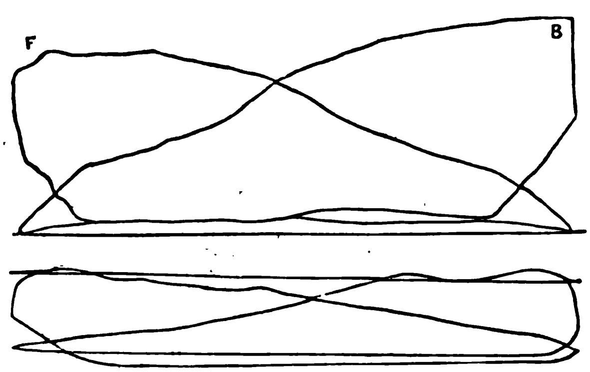
TEMPERATURE AND HORSE-POWER.

To the Editor of THE MARINE ENGINEER.

SIR,—The enclosed tracings are from diagrams of a pair of engines built in the north of England in 1877.

You will observe that the range of temperature is much more in the high-pressure than the low-pressure cylinders.

What alteration can I make to the set of the slide-valves to equalize the range of temperature and horse-power?



¾-turn.

Steam	.. .. ..	60	Mean Pressure.		
Vacuum	.. ..	23½	H.P.	.. .. ..	28·5
Revolutions	.. ..	58	L.P.	.. .. ..	7·7
H.P.	.. .. ..	308			
L.P.	.. .. ..	292	Range of Temperature.		
			H.P.	.. .. ..	87°
Total	.. ..	600	L.P.	.. .. ..	59°
Difference	..	16	H 33	L 62	
°/o ..	.. ..	2·5		39	

2,300 tons.
198 miles.

10 tons bad coal.

Yours truly,

ODESSA, *Feb.* 19*th*, 1887. DAVID ROBSON.

[It is impossible to particularly advise you as to what might be done by altering the set of the valves, unless the whole arrangement of the engines and valves were known to us. We conclude from the diagrams that an intermediate receiver is used between the two cylinders, which, we suppose, are compounded, though you do not say so. The H.P. seems to be fairly equal—at least, that is what we gather from your figures—and the range of temperature being higher in the high-pressure cylinder than in the low is an advantage rather than otherwise.—ED. M.E.]

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

March 5th. Balfour, Andrew, Extra 1 C Leith.
" 12th. Horne, Adam .. Extra 1 C Leith.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

December 24th, 1886.

Sydney, Chas. A. 2C London

February 12th, 1887.

Allan, Frank.... 2C Liverpool
Baggs, Thos. H.. 1C "
Bousie, George .. 1C "
Brennan, John B. 1C "
Forbes, John H. . 2C London
Fullerton, Alex.. 1C Leith
Girdwood, John.. 1C "
Gordon, Charles . 2C "
Lees, Edwin .... 2C Liverpool
Malcolm, Wm. .. 2C London
Margrave, A. L.. 1C N.Shields
Martin, Thos. H. 2C Liverpool
M'Carthy, Chas.. 1C "
Mick, John...... 2C Leith
Mitchell, David.. 2C London
M'Kendrick, Jos. 2C Liverpool
Nicholson, Jo eph 1C N.Shields
Pirie, William .. 2C "
Prior, Hugh .... 1C "
Ramsay, Wm. R. 2C Leith
Sadler, Thomas.. 1C N.Shields
Scott, Ralph .... 2C "
Spence, James .. 1C Liverpool
Sturrock, Alex.. 1C Leith
Trip, T. H. .... 2C London
Vallance, Arch... 2C Leith
Wilson, William . 2C "

February 19th, 1887.

Adair, Robert .. 2C Glasgow
Ashton, Henry H. 1C Cardiff
Bain, Aulay .... 1C Glasgow
Barclay, James.. 1C "
Bergstrom, C. A. 2C N.Shields
Bjorck, Karl J... 1C W.Hartpl
Bray, George E.. 1C Cardiff
Brown, Joshua .. 1C N.Shields
Coley, Arthur B. 2C Southmp'n
Cook, James H.. 1C N.Shields
Cooper, Harry B. 1C Glasgow
Cowley, George V. 2C Plymouth
Davies, William . 1C Cardiff
De Jong, Cornells 2C Glasgow
Dixon, Thomas E. 2C W.Hartpl
Goding, James .. 2C "
Hands, Josiah .. 2C N.Shields
Hawkins, Thos. S. 2C London
Hind, John .... 1C N.Shields
Howatt, Joseph.. 2C Liverpool
Johnson, Joseph . 2C "
Jones, Thomas .. 1C Cardiff
Laird, Henry .. 2C Glasgow
Latus, Thomas .. 2C Hull
McManns, G. R.. 2C Liverpool
M'Hugh, Patrick 1C N.Shields
Minto, John C... 1C W.Hartpl
Moffat, Duncan T. 2C Liverpool
Mollet, F. W. .. 2C London

A NOVELTY IN ANCHOR HOUSING.—Mr. Wasteneys Smith, of Newcastle-on-Tyne, patentee of the well-known Smith's stockless anchors, has recently introduced a simple method by which stockless anchors can be drawn up and stowed in the hawse pipes of the vessel, nothing but the flukes remaining outside lying flat against the side of the bow. No alteration is required except hawse pipes slightly larger than ordinary to admit anchor shank, and the many advantages accruing from this system are at once apparent, no anchor cranes, davits, blocks, falls, &c., being required and therefore first cost and renewals of same saved—"catting and fishing" gear entirely dispensed with—and nothing on fore part of vessel to obstruct the sight. This new system of stowing Smith's anchors has already been adopted by many shipbuilders and owners, and bids fair to effect a complete revolution in this part of a vessel's outfit.

THE "ETRURIA" BEATS HER OWN RECORD.—Outward Passage.—Left Liverpool for New York direct on Saturday, February 12th, at 3·10 p.m. and arrived at Sandy Hook, on the following Saturday at 6·0 a.m. The daily runs were as follows: Sunday, 431, 480, 476, 468, 439, 465, and 361, thus making a total distance of 3,120 knots, in the remarkable short time of 6 days, 19 hours, 47 minutes mean time, or an average of 19 knots per hour all the way across. Homeward Passage.—Did not leave New York until Sunday, owing to fog. Left New York and passed Sandy Hook at 10·40 a.m. February 27th. Arrived at Queenstown on the following Saturday, March 5th, at 7·43 p.m. at Liverpool, Sunday, March 6th, at 9·27 a.m. The daily runs were as follows: Sunday, 30, 457, 450, 430, 472, 462, 460, and 130 to Queenstown, and 240 to Liverpool, thus making the total distances 2,890 and 3,130 knots (the former to Queenstown, the latter to Liverpool), in the marvellous short time of 6 days, 4 hours, 36 minutes mean time, and 6 days, 18 hours, 20 minutes mean time. The average speed of the former being 19·5 knots per hour, and of the latter 19·3 knots per hour. Being on the southerly track the distances are increased at least 100 miles.

The Marine Engineer.

LONDON, MAY 1, 1887.

EDITORIAL NOTES.

IT is only egotism for the present generation to suppose that we have reached the acme of perfection in anything, more particularly perhaps in mechanical and engineering progress. Yet it is very difficult to realize the possibility of a revolution in the production of power, such as would reduce the expenditure for power to a much lower amount than has at present been realized. Scientists are, however, quite prepared to admit the possibility, nay the probability of this result, as it is well known to them that not much more than 90 per cent. of the theoretical value of fuel is utilized in the ordinary steam engine. Many of these known sources of loss are avoidable by utilizing the expansive force of heat direct, and of this form of engine, gas, hot air, and petroleum engines are already known. It is generally accepted that as far as practical results have gone, such engines cost from a halfpenny to a penny per I.H.P. per hour for the fuel consumed. A Mr. James Hargreaves, of Widnes, and formerly of Preston, seems to have devoted many years and much capital to the further development of this subject, and his results as returned within the last few days are certainly somewhat striking and startling if confirmed in practice. He is said to have obtained over 30 H.P. by a combustion of two gallons of coal tar per hour. He also hopes to do even better than this, as the present engine being only the second one constructed for experimental use is far from perfect, and is scarcely fit for the increased strains on the working parts which would be necessary in getting higher efficiency. With the present price of tar the cost of the development of the above power would amount to about one-twentieth of a penny per I.H.P. per hour. We understand that very high temperatures are used within the working cylinder, though great care has been taken to keep the working surfaces at a low temperature. The products of combustion are utilized to do the work directly, and the expansive force is so thoroughly absorbed as work, that the hand can be held in the exhaust pipe without injury, though all the products of combustion are discharged therefrom. Shale oil, crude petroleum, or the waste remaining after refining petroleum are said to be equally available as the coal tar. We think the real test for practical efficiency of this engine will be the point as to how far the residues of the tar are prevented from injuriously depositing upon the working surfaces of the engine. We shall be glad to hear further reports of how Mr. Hargreaves' experiments succeed. Another most serious question as affecting the utility of the engine for marine work is the weight of engine necessary to develop a given power, as most gas, hot air, or petroleum engines are many times heavier power for power than a steam engine. This becomes serious in a steamship. There seems to be also such a general proposal to utilize liquid fuel as far as possible in place of solid fuel, that we should not be surprised if the demand had considerable effect in raising the price of liquid fuel should it come into general use. This will again materially affect the question of economy.

A MOST important series of papers have been read before the Institution of Naval Architects at their late meeting, and as we are unable to print all of them *in extenso* we will endeavour to give a concise synopsis of some of the subjects. The "shifting of cargoes," by Professor Jenkins, is a subject the importance of which has long been recognized, even to the extent of several Acts of Parliament, to regulate the nature and position of cargoes in bulk. That such legislation has had considerable effect in reducing the number of casualties in grain-laden vessels is obvious from the statistics of the preceding ten years. From 1874 to 1880 the proportion of grain-laden British vessels foundered or missing at sea steadily rose, but in the next triennial period, during the whole of which the carriage of grain cargoes Act was in force, the numbers were reduced by over 40 per cent. If also allowance be made for the natural growth of the grain trade, the amendment in consequence of such legislation is still more marked. There is no doubt that the larger proportion of such losses have been brought about by the shifting of the cargoes, notwithstanding that they had been laden in accordance with the requirements of the Act. Professor Jenkins, therefore, has entered into a series of investigations as to the effect which the motion of a vessel at sea has upon the tendency to shift a cargo of grain, and submits the results to the Institution. It is first to be noted that grain, like all other loose pulverised material, has a natural angle of repose, and it is only when this angle of repose is exceeded that such bodies roll by gravitation down the slope. Professor Jenkins further considers that the movement of a vessel has a very great effect in increasing the tendency of the loose cargo to roll to a much greater extent than if it was mere rocking motion in a fixed plane. Close analytical investigation of the resultant forces operating upon the cargo of grain in a rolling vessel show that the free surface of the

grain will tend to shift when a vessel be rolling in still water at a smaller angle than when steadily inclined. Also that a greater tendency to shift exists in the centre of a vessel than at the ends, and also that grain with a free surface in the upper 'tween decks has a greater tendency to shift than grain in the hold. The consequence as regards pitching would obviously be so slight in a longitudinal direction that it may be entirely neglected. Further, heavy blows struck by a sea upon a vessel rolling towards the sea containing a grain cargo may have considerable effect in causing particles to jump out of their place and roll downwards. A vessel's stability also is an important factor in determining inclination at which shifting begins. Professor Jenkins thinks that coal cargoes, though exempted from special legislation, are quite as likely to be affected by abnormal shifting, by reason of the rolling or other motion to a vessel at sea, as grain cargoes, and as the coal cargoes would only be stowed approximately at the limiting angle of repose in still water, it is evident that danger of shifting would immediately ensue in rough water.

YACHT sailing and yacht building has become almost entirely an English pursuit, and may be considered to have been developed within the last 50 years. Mr. Dixon Kemp contributes his experience of 50 years of yacht building to the transactions of the Institution. The practice of building fast yachts has undergone considerable modification, the first notable achievement having been secured by Mr. White with the *Waterwitch*, in 1832. The cutter rig has, however, proved so vastly superior in point of weatherliness that it has been almost invariably adopted for yacht racing. Mr. John Scott Russell had great difficulty in finding acceptance of his theory that the bow should be longer than the stern to make a fast weatherly yacht, and though the *Mosquito* cutter was built by Mr. Mare, exaggerating if possible Mr. Scott Russell's views, so strong was the prejudice against the appearance of such a build that nothing more was done with it at that time, though the *Mosquito* proved herself an exceedingly fast and weatherly craft. In the meantime the Americans were developing their build after the model of a flat bottomed coaster with extreme breadth of beam and centre board, and eventually in the *America* the principles first exemplified in the *Mosquito* were again embodied with extraordinary success. The immediate effect of the *America's* success in England was a new era in yacht design following in the path of the *Mosquito*. When yacht racing became general the allowance for difference of size effected considerable modification in the design of the yachts. As the length and beam were the only dimensions taken into account for rating, there was an obvious advantage to be gained as a matter of rating by using the smallest possible beam with a given length. This was effected by lowering the ballast to the lowest point of the keel, that is by placing it outside. There still further exists considerable prejudice, particularly in America, against the deep narrow type of British build, and they have eventually made a compromise between their peculiar broad beamed shallow yacht with a centre board and the English deep yacht, which is embodied in the *Puritan*, which defea ed the *Genesta*, as far as is known, on her merits; and last year the Americans were again successful against the *Galatea* with another yacht of this same type.

MR. G. A. CALVERT contributes to the transactions of the Institution a most able investigation of the results of forces acting upon the blade of a screw propeller. The author follows up Mr. Froude's method of investigation and analysis of the action of screw propellers of different proportions, or of different portions of the same propeller, and thus to indicate the effect of any modification of pitch, slip, velocity, surface, shape, or thickness of blade. A great deal of scientific work has been expended from time to time upon the nature of forces acting on screw propellers, but it is a curious fact that such work has not hitherto enabled engineers to make any very great application of such principles to improve the design in screw propellers to the maximum efficiency. Mr. Calvert has given great attention to the further development of this subject, and has demonstrated his results by experimental apparatus so as to express more clearly to practical minds the various results arrived at. The apparatus consists briefly of a carriage arranged to run along a floating tramway, and has rigidly suspended from its under side a hollow metal blade of plano-convex section and of adjustable breadth, giving sixteen alternative sections of breadth ranging between 12 in. and 24 in. The whole blade, although rigidly attached to the carriage, can be adjusted so that its flat face may lie at angles from nothing to about 15° with the direction of motion of the carriage, and the latter is hauled along the floating tramway at a regular but adjustable velocity by a line and falling weight. The bottom or tip of the blade is immersed about 2 ft. 9 in. below the surface of the water, and a portion of the blade 3 in. in depth (being the part included between horizontal sections at 3 in. and 6 in. from the tip) is of precisely the same contour as the

main portions above and below it, but separated from them by a space of about 100th of an inch. The object of the experiments was to ascertain the character and magnitude of the forces acting upon this separate movable section when drawn through the water at various velocities and at different angles of inclination. The sum of all the forces consequent on such motion may be conveniently resolved into two components, one acting at right angles to the flat face of the section, the other acting parallel to the flat face; and to effectively measure successively each of these two components, two alternative parallel motions are fitted to carry the blade section. The pressure from these parallel motions was readily communicated by a wire cord to a suitable indicator. This indication is communicated to a paper drum on which time markings are made by an electric pencil, so that exact measure of velocity can be obtained in combination with the variable resulting pressure on the blade. By this means the author has obtained a series of diagrams showing the variations of the pressure of various velocities. The results of these experiments appear to show that the normal pressure and resistance does not vary directly with the square of the velocity, but which appears to be more correctly indicated by a ratio of variation as the 1·85th power of the velocity. Other diagrams were taken to show the manner in which each successive addition to the breadth affected the normal pressure. From this it appeared that the pressure, instead of increasing directly as the area, varied as the breadth of the blade in the direction of its motion multiplied by a constant. The author deals from these results with the variations of sections, and gives tabular arrangement of the thrust and resistance of each and proportions of the I.H.P. of the engines to the various parts of the blade. The variable effect also of removal of any part of the blade or increase in velocity or change of angle may be defined from Mr. Calvert's experiments, which should therefore prove of great utility to those responsible for the designing of propellers.

Professor Cotterill has devoted his attention to the changes of level in the surface of water surrounding a vessel, which may be produced by the action of a propeller, and by skin friction. The levels resulting from these two actions may be supposed to be complements to one another, the propeller race being apparently elevated slightly above the surrounding water, and a depression being generally caused by skin friction. Professor Cotterill obtains his theory from comparing the paddle race to the water flowing uniformly in a canal, by which he proves that a paddle race is properly elevated by a small quantity which depends upon the slip ratio expressed in terms of the speed of advance. At great speeds a depression might be formed and not an elevation. Professor Cotterill carries his investigation farther, to the effect of propellers producing depressions by reason of excessive speed, where he points out that under certain conditions a body of water may be depressed some distance ahead of a propeller or paddle, and that this condition is analogous to the circumstance of a propeller placed at the stern of a ship, where the propeller draws water through it at a greater speed than it would pass through if the propellers were not working. This may throw some light upon the result defined last year by Mr. Seaton, that in vessels with a full stern the proportions and dimensions of a screw become entirely different for those with a clean run. The depression of the stern of a ship may be considered to be analogous to the "negative wave of translation" considered by Scott Russell. It is well known that such wave cannot exist alone; it is always followed by a train of waves which rapidly exhausts its energy unless maintained from some external source, and it is therefore probable that the screw in this case generates its own system of waves, which become a part of the wave resistance of a vessel. The crest of a wave must lie immediately astern or actually above the screw, as it is sometimes distinctly visible, and this possibly may once more increase the thrust, the speed of rotation of the race, and sinkage. To sum up it is suggested that one of the largest augmentation of the resistance of a vessel by the action of a propeller may be the acceleration of the water which supplies it before entering the propeller. This resistance would consist in a lowering of the pressure in a whole mass of water lying between the screw and the vessel, thus augmenting the resistance of the vessel and the thrust of the screw.

Boats and Life-belts for Ships.—Mr. Howard Vincent, M.P., has introduced a Bill dealing with the provision of boats and life-belts on board ship. He proposes to make it compulsory on every vessel exceeding 15 tons burden that navigates the ocean or any river, lake, bay, or sound, or plies to and from any port in the United Kingdom, to be provided, not only with such numbers but also with such kinds of boats, lifeboats, floats, and rafts as the Board of Trade may by their rules and regulations fix, so as best to secure the safty of all persons on board in case of disaster; and every vessel that is licensed to carry passengers is required by the Bill to be provided at all times with a serviceable lifebuoy or belt for each passenger allowed to be carried, including the officers and the crew. These life preservers, which are to be kept in good order and in convenient and accessible places in readiness for immediate use in case of accident, are to be of suitable material and of a pattern approved by the Board of Trade. Whenever a vessel is not provided with boats and life-saving gear in accordance with these requirements the master is to be liable to a penalty not exceeding £100 and not less than £5.

INSTITUTION OF NAVAL ARCHITECTS.

SESSION, 1887.

THE RIGHT HONOURABLE THE EARL OF RAVENSWORTH, President, in the Chair.

THE PRESIDENT'S ADDRESS.

THE PRESIDENT: Gentlemen, I rise to move the adoption of the Report which you have had read to you, but the first duty which devolves upon me is a very sad one. It has reference to the last and only recently introduced paragraph in the Report, which announces to us all the loss, quite lately, of a valued friend and highly esteemed colleague. It is my duty—a very painful duty—but nevertheless one which I shall not shrink from performing because it is a real duty, to tell you that the Council of this Institution desires to place on record its sense of the great loss that the Institution and the country have sustained in the early death of their esteemed and honoured colleague, Mr. William Denny. Those are expressive words, gentlemen, and I thoroughly believe that they express the feelings of every one of us in the loss that we have sustained. We all remember the energy, the ability, and the zeal with which our late friend took his part—his valuable part—in all our discussions; we know how successful he had been in the conduct of a great business, we valued his opinions whenever they were expressed, and we all feel that his loss goes far beyond the limits of this Institution, that it will be deeply felt in his own country, and that it will be felt by all those students of naval science to whom he was a brilliant example. I am quite sure, gentlemen, that you will approve of the proposal of the Council that our expression of sympathy and condolence be conveyed to his venerable father, who is a very great personal friend of my own, and his family, upon their great loss.

Now, gentlemen, I must pass from that sad subject and ask your permission to make some observations to you in the shape of introductory remarks. In looking back upon the year which has passed, I think I may describe the year which has just gone by since we last met in this hall, as a bad and uneventful year. I think it is chiefly remarkable in a commercial sense, as having been perhaps the worst on record, and therefore, I think you will very likely agree with me, that the less I say about it the better. We will hope for better times, and, in fact, I trust that those better times are beginning to exist, although I think it is quite a correct expression to use in regard to the past year that it was an uneventful year. That expression cannot by possibility apply to the present year, the Jubilee year of our Gracious Queen, and I do not think, when every loyal subject of Her Majesty throughout the length and breadth of her vast dominions is striving his utmost to do honour to that Jubilee, each in his own way, that you will consider it altogether inappropriate to the year and to the occasion on which we are met if I ask you to look back to the commencement of Her Majesty's reign, and if I attempt to mark in a few observations some of the steps of progress that Her Majesty herself has witnessed during the course of her reign, in steam navigation and the progress of the mercantile marine of this country. Now, gentlemen, fifty years ago steam navigation was pronounced to be a hopeless enterprise, and that observation was made, not by unlearned persons at all, or ignorant persons, but by highly scientific authorities. In 1835, Dr. Lardner, who as you all know—and I knew him myself, and remember him perfectly—was a very highly scientific authority, pronounced that any attempt to send a steamboat across the Atlantic would prove a chimera, but he does not appear to have been very strongly impressed with the soundness of his own views, because he fixed in that same year, I think, or very shortly afterwards, the ultimate size of Atlantic steamers at 800 tons and 200 H.P. Now it is rather a singular coincidence, but if we multiply the first of those figures by ten, and multiply the second figure by 60—a very simple sum, because I have done it—we shall arrive almost precisely at the tonnage and at the power of the *Umbria*. She is 8,000 tons, and she has an I.H.P. of 12,000, and I am informed this morning that the *Umbria* crossed the Atlantic in 6 days and 9 hours, arriving a couple of days ago. That is a considerable stride I think you will allow. But the learned Dr. Lardner's prognostication was very soon falsified, in fact in 1838, only 3 years afterwards. But by-the-bye, gentlemen, before I come to that, I should like to remind you of a very interesting matter in connection with a very eminent man of those days, a brother of a great friend of my own, and the uncle of our kind and generous host last year, the Messrs. Laird of Birkenhead, and we all have the most delightful recollections of our visit to Liverpool I am quite sure—Mr. Macgregor Laird, and I want you to kindly pay attention to these words because they are the most pregnant words, and the truth of them has been fulfilled and demonstrated every year since they were uttered—Mr. Macgregor Laird, in 1835, took up the cudgels in favour of steam navigation, and particularly Atlantic navigation, and wrote a very remarkable and able letter in answer to Dr. Lardner's sinister prognostication, and used the words: "All my experience has proved that we have never yet had to complain of the size of a vessel if the power has been proportionately increased." There is a great maxim I think contained in that statement, and it only shows the value of an experienced far-seeing sagacious man, compared with the theoretical knowledge even of a very highly scientific man. There is one other passage in that letter of Mr. Laird's which is worthy of remark as being written 50 years ago. "Double power" he says "propels more than double bulk," and I think that the record of steam shipbuilding will bear out the truth of both of those maxims. I was going to remind you that in 1838, and curiously enough within two or three days of the time at which we are now assembled here, the *Sirius* and the *Great Western* started for New York. The *Sirius* was a little boat of 700 tons and 320 H.P.; she was built at Glasgow. The *Great Western* started only three days after her. The *Sirius* starting on, I think, the 2nd or 3rd of April, I believe the 3rd of April. The *Great Western* was a much bigger boat, 1,340 tons hold measurement and the engines were 440 H.P. They started within three days of each other, but the more powerful boat gained two days on the passage and they both arrived at New York within a very few hours of each other, and caused immense excitement on the other side of the Atlantic. The average speed of the *Great Western* was 208 miles, not knots, a day, which comes to eight and a small fraction miles an hour and is by no means a bad performance, I think you will say, as an early start of steam navigation across the Atlantic. But, gentlemen, the *Etruria* came across the other day, and to use a sporting phrase, beat the record of the famous greyhound, the *Alaska*, because she came over in 6 days, 9 hours and 18 minutes, and probably would have done it in less time only that she met with a fog on the Irish coast. There is a considerable stride I think in steam navigation across the Atlantic in those 50 years. Gentlemen, I should like to go on if you will allow me and mention a circumstance or two connected with steam navigation only 30 years ago, because we heard that very able man, the chairman of the P. & O. Company, telling his shareholders in December last at their annual meeting, that 30 years ago that Company built the *Himalaya*, and she was the largest merchant ship then in the world. She was so large that Mr. Sothern found that the Company were obliged to sell her to the Admiralty, and I am bound to say I do not think the Admiralty ever made a better purchase. She has done true and loyal service to the Queen ever since. I believe she is a good ship now, and I hope the P. & O. Company will be fortunate enough to have a great many more *Himalayas*. And what did he tell you? What did he tell the world?—that the Company were building four vessels nearly twice her size. That is truly a considerable advance in steamship construction in 30 years. Mr. Sothern is too able a man to have forgotten it, but I should like to fill up the blank; the *Himalaya* could not have possessed the title for more than a few months because it so happened that the *Great Eastern* was launched, or at least began to be launched, in 1857. She started her launch in the early days of November, and she floated of her own accord on the last day of January following, so that she was three months on that passage; however, it was attained at last. I should like to dwell a little on this, because certainly the launch of that ship is a great event in Her Majesty's reign, because notwithstanding all that has occurred, and all that has been said, and all the abuse heaped upon her, I believe the *Great Eastern* to be certainly the biggest, and I believe the strongest, ship that ever was built. I have always taken a great interest in this ship because of our late lamented friend, Mr. Scot Russell, and the great engineer also who designed her; but it is a very satisfactory thing to my mind, and, I think, to everybody who considers it, that there is a prospect of that great ship rising from her ashes like a Phœnix, and that, too, shortly, because it really is not a figure of speech to say that the last time I saw her, and many others saw her, she was in dust and ashes lying in the Mersey degraded to the position of a dancing saloon, her magnificent sides covered with every sort of parti-coloured advertisements, and a parcel of acrobats crawling about in her maintop instead of sailors. It is satisfactory to hear that she has been purchased, and that new engines are to be put into her. I presume also she will have twin-screws, because surely they will not trust such a ship as that on a distant ocean voyage with a single screw, and she is to be

the pioneer of a new line of fast steamers to Australia. Now there is a very remarkable circumstance which I should like to point out to you in the history of this ship. She has been several times across the Atlantic, she has conveyed troops to Canada, she has laid Atlantic cables, and she has been more useful, I believe, in that capacity than in any other, but she has never been to Australia, and she was designed for the Australian trade purposely, and built for that trade—she has never been there, but we all hope, as I said before, that this new adventure of hers will prove a successful one. I believe that she was really too big for the trade, but I think that remark can hardly apply now, and we hope that it will not, but I think the secret may be told in very few words, that she consumed 210 tons of coal per day, and she was designed to go to Melbourne in 45 to 50 days; that was the estimate formed of her performances, and she was to run at a rate of speed of 15 knots, but she never attained that speed on any of her voyages, and I do not believe that except once or twice under the most favourable circumstances, wind favourable and aided by her sails, she ever did more than 14½ knots, but it so happens in regard to the consumption of coal that the *Etruria* beats her even in that, for the *Etruria* consumes 300 tons of coal per day, that is 12 tons an hour; but mark the difference. Her average in 9 consecutive voyages has been 18 knots an hour, and as I told you she came over here the other day making the fastest passage which was ever made by a steamship across the Atlantic. Well now, gentlemen, going on to point out the great improvements that have been effected during the 50 years of Her Majesty's reign, I should like, with your kind permission, to allude to two vessels only which I think fairly describe the latest and most improved types of ocean steamships. One is a Wear-built ship and the other is a Clyde-built ship, and in mentioning them I shall not be accused of any particular favour or partiality to my own river, because neither of them belong to the Tyne; but they are remarkable types of ships and they have characteristics which, I think, will interest those who hear me when I very shortly describe them. The one is a Transpacific. She was originally named the *Nulli Secunda*, and many of you who were at Liverpool will remember how much interest was taken in her models. They were very beautiful models. This vessel is a cargo boat, and she is a remarkable and good illustration of the immense progress that has been made in steamship building up to the present time. She is 440 ft. long, 48 ft. in breadth, and her hold is 32½ ft.; she is entirely composed of Siemens' steel with the exception of her deck-houses, which are of iron. She has two steel decks fore and aft and a third deck. The upper steel deck is sheathed. She has a fourth deck in her forehold, and she is further subdivided by seven watertight bulkheads. Each of the compartments—this is a remarkable characteristic of the ship—is about of equal capacity, and each hold is fitted with a large hatchway and two patent swinging hydraulic cranes. The midship hold is further subdivided by bulkheads, and is also fitted with a third crane. All these holds can be emptied at one and the same time. She is very high between her decks, and consequently would be an extremely valuable vessel for the conveyance of troops or cattle or any live cargo. The gross register is 5,600 tons, and her speed, loaded with passengers, is 12 or 14 knots on a consumption of about 50 tons of coal per day. Her engines are triple-expansion of 4,000 I.H.P. I think you will say from that short description that she is a very fine specimen of a modern cargo boat. Now, the next vessel I want to allude to is that magnificent vessel which left the Clyde only a short time ago, described as being the largest vessel of her class—the largest passenger steamer that ever entered the Thames. I mean the *Ormuz*. She was built by the Fairfield Company, and she has lately arrived at Adelaide within 31 days steaming. She has remarkable characteristics—she is an Orient liner, her length is 481 ft., her breadth is 52 ft., her depth 37 ft., her displacement at the load-line 10,500 tons; her gross registered tonnage is 6,116 tons; I.H.P., 4,000. Her speed was 18 knots on her trial and she is divided into 10 compartments, and this is the remarkable characteristic about this ship, that she can be made watertight by closing her iron doors by powerful screws worked from the main deck. There is another peculiarity about her, that the doors nearest the engine-room fall by their own weight by means of the withdrawal of a short iron bolt, and they are sharp at the bottom—I hope they will not serve as a guillotine to anybody who unfortunately may be passing under them, but I cannot help thinking that the designer of this vessel must have had in his mind the lamentable occurrence of the *Oregon*, because the weight of these doors and their sharpness is sufficient to cut through any obstacle which there might be to prevent their passage into their case. Those are her peculiarites, and I venture to mention them because I think they are very fine specimen illustrations of the vast improvement that has taken place; one being a cargo boat, the other being a passenger steamer quite lately built.

Well now, with all this immense progress and improvement it is a very melancholy thing to consider, but it is, I am afraid, too true, that within the last three years steamship property has depreciated no less than 30 per cent. We have high authority for it, and I do not think when we come to consider it the causes of that depreciation are very far to seek, because they are very numerous. I must, by-the-bye, allude to this, because before I proceed further I wish to show you a very interesting circumstance, that is the increased tonnage as it has to do a good deal with that depreciation—the increase of the tonnage that has taken place in steamers since 1855, only 30 years ago. These figures are taken from a very valuable work published by Lloyd's — Lloyd's Universal Register—the accuracy of which we cannot, of course, dispute. The figures were used by the very able President of our local Institution—the North-East Coast Institution of Shipbuilders and Engineers—whom I am sorry to see is not here to day. Those figures which were taken as the basis for his statements were from Lloyd's Register, and I should like just in passing to remind everybody of the circumstances of his lecture. It dealt with a subject which is almost entirely novel, and if anybody wishes to pursue it I cannot do a better thing than to recommend him to turn to that lecture and study the figures, because the subjects he dealt with were not only the size of our merchant fleets, the numbers of them, but also other conditions. It is a very interesting subject, and I allude to it in passing. Having disburdened my breast of the plagiarism, I will now use two or three figures to show you what the increase of tonnage in our steamers has been during the last 30 years. You will find it very interesting. From 200 to 500 tons, the increase has been 4 fold; from 500 to 1,000, 7 fold; from 1,000 to 1,500, 25 fold; from 1,500 to 2,000, 43 fold; from 2,000 to 2,500, 37 fold; 2,500 to 3,000, 28 fold; and 3,000 to 4,000 tons, 37 fold. I think, gentlemen, that you will admit that that is a marvellous advance in the size of steamers, bearing in mind Mr. Macgregor Laird's prognostication that size eventually would mean power, and I take it you would all agree to that maxim nowadays, that size really does mean power. The figures that I have just quoted refer to no less a number of steamers than 7,889, of 9,855,560 gross tons, and no less than 44 per cent. of that vast aggregate tonnage has been built since the year 1883, or very nearly half. Now, gentlemen, I began by talking of the depreciation in the value of steamers in the last two years. I think that that goes a long way to explain the depreciation, because no doubt an immense amount of that building, or at least a very large amount, was of a highly speculative character. We also know that shipowning has fallen of late years into a totally new set of hands, and a vast number of persons, I am afraid, have invested their savings in shipping who know absolutely nothing about the business, in fact know so little that they have hardly, many of them, been able to select managers who did know much more. That I think in itself leads to a great amount of this speculative building which undoubtedly accounts for a good deal of the depreciation, but not entirely. The establishment of shipping companies on the limited liability principle of course increased that speculation. But that is not all. Formerly, England used to build ships for all the world, and now all the world is building ships for itself. There is another reason, I think, and in the face of declining trade it is easy to conceive that such a depreciation as I have mentioned should have taken place, the foreign competition which used to be laughed at, but which has become a very stern reality, is largely assisted by foreign States by an artificial system of bounties, and although it suits some authorities to laugh at bounties, it is a fact that they are a very serious handicap, and so long as those nations are found to pay those bounties, that handicap will remain, and that is a very serious consideration to those who are competing in the great ocean lines of steam navigation. I think that that is pretty nearly enough to account for this depression. In the five years from 1881 to 1886 there were no less than four millions of tons of steamers built, as against two millions of tons in either of the preceding five years, namely, from 1876 to 1880, and from 1871 to 1875. I will not trouble you with statistics upon that point, but I may broadly say that speculative building appears last year to have ceased, I hope, for some time, because the aggregate amount of tonnage built in round numbers is 460,000 tons in our various shipbuilding establishments, and the amount removed from the register by sales, losses, and so on, was 400,000, and the declension is still going on. It is largely in sailing ships, but

still that is a very small increase over the actual amount of removals from the register in one year, so that that evil is probably correcting itself. Well now, gentlemen, there are two matters which I think account largely for, and are rather chief features in the last improvement that has taken place in shipbuilding in the time over which these remarks extend; one is the introduction of the triple-expansion engine, and the other is the employment of steam in the building of ships. I believe that a great proportion of ocean-going steamers are now fitted with the triple-expansion engine. I observe that high authorities do not think it safe to calculate upon any much larger saving of fuel by the use of the triple-expansion engine than 25 per cent., but they all agree upon this point, that it is an indispensable condition of giving the full advantage to that principle of triple-expansion that each cylinder should be provided with its own crank. I believe that to be a maxim which has received general acceptance. The 25 per cent. saving of fuel must be taken at a pressure of 150, which we all know is a very usual pressure. Well now, there is another point upon which there does not seem to be the same concurrence of opinion, and it is an interesting point. I will just allude to it in passing. I think there is a good deal of difference of opinion as to whether, in order to obtain the full amount of work out of a given body of steam, it is or is not necessary to jacket the high pressure cylinder. There seems to be a good deal of discussion going on upon that point, which is a very interesting one. I heard a very high authority say the other day that he had doubts whether the jacketing was worth the trouble and bother which it took. That is a matter, of course, for engineers to settle, but there seems to be a great deal of discussion going on about it at the present time. I have alluded to the second great improvement—the introduction of steel as a material for shipbuilding. I do not believe that these pressures could have been reached had it not been for the introduction of steel in the boilers, which enabled these great pressures to be used with safety. Not only that, but we find these high pressures do not cause detriment to the boilers. It is not only in the hulks of ships that steel is now so largely used, but its use is increasing in the working parts of the machinery, and that is a very important improvement, because the use of steel in the working parts of the machinery and the engines is accompanied with no more wear and tear, and it also admits of a higher piston speed with no more wear and tear, and that higher piston speed, again, admits of smaller engines with equal power, or much greater power with equal-sized engines. Now six years ago steel only represented 10 per cent. of our steam tonnage, and it is now considerably more than 50 per cent., and upon the Clyde, I believe, no less than 66 per cent. of the vessels are built of steel. I have tried to mark some of the chief studies that have been made in the construction of ships and in steam navigation during Her Majesty's reign. I think if ever the phrase "progress by leaps and bounds" could be used with propriety, that phrase may be claimed for the progress of steam navigation and steam shipbuilding during the past fifty years, but although steel has arrived at this pitch of perfection which we observe, and although there is extensive use made of steel, I do not think that anybody would contend that we have ever yet reached perfection in either the manufacture or the manipulation of that metal, or that there may not be yet a good deal to be learned in both those respects in regard to its use. But hardly has it arrived at this high standard when we find another rival in the field, and even if a considerable portion of what is claimed for this new material be true, it is likely to prove a very formidable rival indeed in the future; I was going to say, I wonder whether Her Gracious Majesty, whose life we all hope will be long prolonged, will witness during the remainder of her reign as great progress and discoveries as she has seen in the past. Perhaps I shall be laughed at when I say I think it is quite within the bounds of possibility that she may, and from the few observations which I am going to make on this point, I think you will see I am justified in making such a prophecy. There is a new rival in the field, and that is aluminium—aluminium manufactured by the electric process, and the intense heat which is generated by that process. Now it is claimed for aluminium that it is only one-third the weight of iron, it is as tenacious as iron, as fibrous as iron, that is as malleable as gold, and that it resists all corrosion, but it is as an alloy that its great value seems to consist. As an alloy with copper, that is as a bronze, its tensile strength amounts to no less than 100,000 lbs. per square inch. It casts well and it works well, and its tensile strength in casting has been tested up to 128,000 lbs. Now of course I do not expect any gentleman to believe me upon such a point as this, but I have had an opportunity of talking lately with certainly two very eminent metallurgists, and they both agree in thinking and believing that there is a very great future indeed in store for this new metal, but I should like to quote to you in support of my own belief, opinions that are worth hearing. "Engineering," writing on this subject so lately as last July, says this:—"An ample supply of that metal" (that is aluminium) "would utterly transform all engineering, and might even remodel the conditions of our life. The mind might dwell for days upon the changes which would be effected by the introduction of a tenacious structural material of one-third the specific gravity of iron without being able to grasp them fully. What a revolution it would effect in naval architecture!" Those opinions must be interesting both to the naval architect and to the marine engineer. Another scientific journal, writing some years ago, said this: "Wherever there is necessity for metal work which shall combine flexibility with strength, and which shall be free from corrosion—that seems to be one of its most remarkable qualities—there aluminium will rain supreme." Now aluminium at this moment stands on very much the same footing as the mineral oils of which I have taken occasion to speak before, of which we have heard so much, and for which so many magnificent tank steamers are being built by our shipbuilders at this moment in different parts of the country. The conditions, I say, are similar, because it is a commercial question of the price, but if the price is brought down to the point which is claimed for it by this extraordinary electrical process of manufacture, it seems to me that it possesses qualities far above those even which are possessed by our best mild steel, and the eyes of the scientific world will inevitably be fixed firmly on aluminium as a material for shipbuilding, and upon mineral oil as fuel for the next few years. Now, gentlemen, I have detained you long enough; and there is only one other observation which I will ask your permission to make, I should hardly feel that I was justified in sitting down without alluding to it. The longer I have been connected with this Institution, the more I have been struck with its value as an educational feature in this country, and it is only fair I think to those eminent men who have taken part in the lectures organized under the auspices of the Honourable Company of Shipwrights, and which have been read this winter, to recognize the valuable public services that those eminent men have performed for the country at large in reading those papers. I think it would be impossible to over-estimate their value whether you regard them as historical or as illustrative of the gigantic progress which has been made in steam navigation, both for the purposes of the Royal Navy and for the mercantile service of this country. Not the least of those papers was read by the able president, I am not sure whether he is called the president or the master of the Shipwrights' Company, but I do say that the country is indebted to those gentlemen, and I am delighted to see that the chief papers have been provided and read by the most eminent members of this Institution. I say that they will be of immense value to students, and I hope now that they have once began, that that course of lectures may continue. Gentlemen, I am extremely obliged to you for allowing me to make these few observations; I thought it was not altogether inappropriate to this year that I should just note some of those landmarks which I have only very faintly traced, because it is a subject that would take volumes to do justice to, but they are connected with the year which is in all our minds, the Jubilee of Her Majesty, and therefore I have ventured to make these observations with reference to that progress, and I thank you very much for your kindness in listening to me. I now call on Sir Nathaniel Barnaby to read his paper. (Cheers).

The Iron and Steel Institute.—The council of the Iron and Steel Institute have arranged to hold the spring meetings of the society on the 26th, 27th, and 28th of May next, when Mr. Daniel Adamson will be installed in the presidency, in the place of Dr. Percy.

Spanish Steam Navigation.—The Spanish Government has approved a contract entered upon by the Spanish Transatlantic Steamship Company, which contemplates the establishment of an extensive service. The company's vessels are to carry mails and perform whatever extra service may be required for war purposes. The Government is to pay about 1.83 dols. per mile run on an American line, and lesser amounts for services to the Philippines, Buenos Ayres, and Fernando Po, payments to be made monthly by the Minister of Foreign Relations. All the vessels employed are to be of iron or steel, and they are to be strong enough to carry heavy batteries. The steamers run on the American and West Indian lines are to be of 4,500 tons burden.

THE MERCHANT SERVICE AND THE ROYAL NAVY.

By Sir NATHANIEL BARNABY, K.C.B., Vice-President.

THE Shipwrights' Company did me the honour to ask me to give a lecture as one of the recent Mansion House series, and I had proposed to take this subject. I was prevented from making a final arrangement in the matter, and the lecture was never given.

Within the last few days the Council of this Institution has asked me to read a paper on the subject I had chosen for that lecture.

I do so with the advantage that since I prepared the paper the First Lord of the Admiralty has laid before Parliament proposals which are a distinct advance in the course I had desired to advocate. I had wished to support Lord George Hamilton and Lord Charles Beresford in the policy they had indicated in recent public statements—a policy which sought for some organization in the mercantile marine in order to increase the power of national defence.

The necessity for organization arises from the following facts:—

(1) A fast mail or passenger steamer may be as efficient a factor in a naval war as an ordinary war cruiser which has cost a quarter of a million sterling, and has a crew of five or six hundred men.

There are certain services which she may perform much better than the regular war-ship, by reason of her greater size and superior travelling power.

For engaging with a regular ship of war the inferiority of existing merchant ships of the best and most powerful type is obvious; but on the other hand, their superiority when properly armed to other merchant ships unarmed, or say, of less size or speed, must be admitted.

(2) Excepting these fewfast mail and passenger steamers, merchant shipping is incapable of offering any resistance whatever to an enemy possessing speed and a small armament.

High steam speeds at sea have wrought this great change in the military character of trading ships, viz., that all sailing ships—and we have eight thousand of them of 100 tons net and upwards—have become absolutely helpless; and of the nearly six thousand steamships of 100 tons gross and upwards, more than nine-tenths would be incapable of offering any resistance against a single ship of the superior class included within the remaining tenth.

This superior class has by comparison acquired a value far higher than was ever possessed by a trading ship in the days of sail power.

In those days the fighting value of the armed Indiaman was fully recognised. There is no reason why in a naval war many a brilliant passage of history may not be associated with ships which are not reckoned as part of the Navy. These ships will certainly force themselves into prominence, either in our hands or in those of our enemies.

(3) Provision is made by the State for a reserve of seamen who are drilled periodically, and paid by it, and are liable to be called upon to serve in a war. But there is no link of any kind to connect the useful ships with the trained men.

By organization these superior ships under our own flag may be made a real state possession, and they may be manned mainly by men trained in the Royal Navy, seamen and marines. They may be made available for immediate service on the outbreak of war at any part of the world where they may happen to be, by the action of the Commander-in-Chief on the station.

Without organization, the ships may be found to be seriously defective in some points of detail in construction, which owners would have gladly corrected had they been advised and encouraged to do so.

Without organization, ships from which such defects have been removed may find themselves put on one side in State employment in favour of others in which they flagrantly exist, and even in favour of ships belonging to a foreign Government.

Without organization, ships of the highest speed, and carefully built, may be found at time of need, when the Commander-in-Chief on a foreign station imperatively needs their services, to have not a single trained officer or seaman on board. Thousands of Royal Reserve men may be found in ships having no defensive power whatever, and none in the few ships which have so high a value.

These are, unfortunately, the actual facts.

Read at the Twenty-eighth Session of the Institution of Naval Architects, March 30, 1887.

Not only the Post Office, but the Admiralty itself, employs ships which the Admiralty officers have declared to be seriously defective in structural security. And as to the men, it will be found that the most splendid ships now under the English flag have not a single Royal Naval Reserve man in their crews.

How does this come about? By the following arrangement:—

There are some 250 ships designed and built for fighting.

Including the Royal Naval Reserve there are some 80,000 officers and men for service afloat in these ships.

This *personnel* and *materiel*, known as the British "Navy," is placed under the control of a Cabinet Minister and a powerful Naval Board, to whom the defence of our maritime possessions is entrusted.

There are under the same flag, but built for commerce, near 14,000 ships of 100 tons and upwards, with crews of some 300,000 men.

This is known as the Merchant Service. It is under the control of "The Lords of the Committee of Privy Council appointed for the consideration of matters relating to trade and foreign plantations." They are described in all Acts of Parliament, deeds, contracts, and other instruments by the official title of "The Board of Trade," without expressing their names.

The Lord Chancellor and the Speaker of the House of Commons are both members of this Board, so also are the Principal Secretaries of State, but no one connected with the Royal Navy is included. Even the First Lord of the Admiralty is shut out from the long list of members.

Of the thirteen millions of money taken for the Navy, the only appropriation touching the efficiency of the Mercantile Marine in its military aspect is the retaining fee, and the expense of periodical drill for 18,000 men.

The high State officers named above as constituting the Board of Trade inspect all passenger ships and give certificates that the hull of the ship is sufficient for the service intended; is in good condition; and that the partitions, &c., are in the condition required by Act of Parliament. Acting on this certificate, passages are made, and the Admiralty itself employs for the transport of troops ships having this security and no other.

But what is the real worth of the certificate? It is in evidence that since 1862 the Board of Trade surveyors have had no power to require given water-tight partitions to be fitted in the holds of passenger steamships, although the Board has had no doubt as to the necessity for proper and sufficient water-tight partitions, and has had no doubt that the proper authorities would insist on their being fitted in all steamships employed in the conveyance of mails.

Whatever may have been the expectation of the Board of Trade in leaving builders and designers unfettered in this respect, it is quite certain that Her Majesty's mails are now carried in ships having no such sufficient bulkhead division; and that the Postmaster-General does not trouble himself to ask whether they have or not.

The ship that has such division has no advantage whatever in the postal service over one that has not.

We are, then, in this position:—The Admiralty and the Board of Trade are agreed that certain structural provisions should be insisted on in mail and passenger ships, and yet the latter issue certificates of fitness to ships having no such provision, and the Post Office and the Admiralty employs the ships.

Sir Thomas Farrar may be quite right in contending that the Board of Trade should not tie down builders and designers by general statutory regulations, but should leave them free to provide the necessary strength and security in their ships.

But this licence is inconsistent with the practice of giving certificates of fitness without proper general examination, and notwithstanding that the builders have violated the special condition which is agreed on all hands to be essential to reasonable security.

There are hundreds of British steam passenger ships, of large size, classed at Lloyd's, and running with Board of Trade certificates, of which it may be confidently said that they would inevitably sink if a hole a square foot in area were made in the bottom plating only a few feet below water. How easily such a hole may be made in an iron or steel plate of bottom we al know.

If the Board of Trade gave no such certificates the evil might be expected to right itself.

The Government might then inquire into causes of loss without being hampered by the certificates of their own officers.

I feel confident that wreck inquiries would then throw light on causes of loss which are now accepted as inevitable, but would soon be seen to be capable of remedy. The voluntary associations

for classifying ships would thus have their hands strengthened, and would be able to insist on proper subdivision as a condition of register on their books.

Surveys, assignment of load-line and freeboard, certificates, and classification for the guidance of merchants, underwriters, and passengers should be left to the admirable voluntary associations formed by joint committees of underwriters, shipowners, and merchants.

The rules of Lloyd's Register for freeboard have been virtually adopted by the recent excellent Load-Line Committee, and the Committee of Lloyd's Register might well be entrusted with the assignment of a load-line, just as they now assign the spacing of the frames, and thickness of the plating in the hull. Ships not classed as to load-line would be in the same position as those not classed for structure.

The Committee of Lloyd's Register now class one-third of all the classed shipping in the world. To it and to similar institutions the Government might well entrust the care of shipbuilding, keeping its own hands free while watching the course taken by them, and instituting searching inquiries into the causes of losses which might appear to have been avoidable.

But while the system of survey and certificate by a Government department may thus be seen to be inconsistent with proper inquiry into the causes of loss, the advantage of modern legislation in improving the efficiency and comfort of officers and crews cannot be questioned. The efficiency and well-being of a body of men six or seven times as numerous as the seamen and marines in the Royal Navy is a very serious matter.

Experience has shown that commercial interests cannot be made to cover this ground satisfactorily.

Notwithstanding the benefit conferred by the Mercantile Marine Act of 1850, the Merchant Shipping Act of 1854, and subsequent Acts, very much remains to be done before the lot of the sailor in his housings and surroundings on shipboard can be made to compare at all favourably with life on shore.

Those who have acquainted themselves with forecastle life know how seriously the health of the men suffers from leaks in decks overhead, and condensation upon the bare iron plating, left bare to avoid the worse plague of vermin which soft wood lining fosters.

Our maritime interests are much more dependent on this efficiency and well-being than on that of either our Army or our Royal Navy.

Is it well to entrust it to such control as it now has?

Ought there not to be a Secretary of State for the Navy, having the care of this vast interest, with the assistance of competent men, such as may be found all over the Empire?

Might not the "Royal Navy" be regarded not as *the* Navy, but as a highly specialized department of the British Navy, presided over, as at present, by a Board of Admiralty, but subject also to the Secretary of State for the Navy?

These steamships, built by private enterprise, are an extension of the Queen's dominions. Each of them is a new British territory, often very rich and populous.

Nor does there appear to be any reason to limit their increase in size. It is conceivable that steel ships will be built richer and more populous than many a famous English town—ships not only carrying for traders, but trading on their own account; and providing for permanent residence as well as for transport. Such ships must be armed and garrisoned, and must unite the mercantile and military elements within themselves.

We have not reached this stage yet, but we have reached the position that certain ships built by private enterprise have great national value. Their transfer to a hostile flag would be a grave national misfortune. It is unendurable that this value should not be recognized by the State authorities.

No care is taken to foster its valuable national features, or to preserve its national character. War-ships are built and maintained at the expense of the State which would be of less value in a war, but nothing is done to economize the national resources which are in private hands by maritime organization.

The steps that have already been taken by the Admiralty are said to have excellent results in improving the character of the passenger ships built within the last ten years. The time has now arrived, it is to be hoped, for organization.

To Mr. Ward Hunt, Mr. W. H. Smith, and Lord Northbrook is due all that has been hitherto effected. Lord George Hamilton has an opportunity which he appears to be disposed to use.

He deserves the best wishes of all who know the conditions under which the next great naval war must be fought, and who realize the impossibility of protecting our slow shipping by regular [illegible] of war.

To provide an efficient armament for the fast merchant shipping, and to organize it, is the immediate pressing need for the British Navy, and of the Empire.

The organization must include the engagement of seamen and marines already trained in the Royal Navy; the seamen for the ship work, and the marines for the domestic work on shipboard.

The full pay and pension provision for such men as may be thus engaged might be found by the State.

By this means the number of warrant, petty, and non-commissioned officers and men might be greatly increased, without a corresponding increase in war shipping.

To effect this it is desirable that the close and vital relations between the ships and the men of the two great divisions of our floating Empire should be recognized, and that their present administrative separation should cease.

It has been admitted that the best of the merchant ships are exceedingly defective in their provision against vital injury from shot and in collison.

The best that it has been possible to accomplish, under existing conditions, still leaves these ships with only one propeller, and with an exposed steering arrangement from rudder head to steering wheel.

Both these defects are avoidable without loss of commercial efficiency, but owners cannot be expected to run risks as to commercial efficiency, and to accept possible increase in engine-room expenditure, at their own sole expense.

So also in the matter of subdivision into compartments, the best that has been done in ships like the *Oregon* falls far short of what might be done without loss of efficiency, but with some increase in cost of building and maintenance. Owners are known to be ready to build ships with two screws, with protected steering gear, and with far better subdivision, if the Government would admit that these are matters of national interest, and would treat them and their ships in that spirit.

In a paper explanatory of naval estimates, recently issued by the First Lord of the Admiralty, there is a section upon the utilization of auxiliary resources. It is there stated that the White Star Company had expressed their willingness to build two vessels, to be approved by the Admiralty, of a speed and strength superior to any merchant ship afloat, with engines and boilers below water, with fittings for guns built in during construction, and, when manned, with half crews of Naval Reserve men.

By the payment of an annual subsidy the use of these ships will be obtained, under an agreement for five years, at a price fixed beforehand, both as regards hire and sale.

This arrangement with Mr. Ismay, and a similar one made with the Cunard Company for three of their ships, are the final outcome of a proposal made by Mr. Ismay in 1878.

At that date he offered the following terms:—

He was willing to make an agreement with the Admiralty for the transfer of certain ships for the purposes of the State in time of war as follows:—

1. The payment of ten shillings per ton (gross register tonnage) per annum as a retainer when not employed by the Admiralty.

2. The payment of twenty shillings per ton (gross register tonnage) per month for each particular ship when and so long as it is employed by the Government.

3. The ship to be taken at the entire risk and expense of the Government when exclusively employed by the State.

The value of the ship to be determined by the current building rate of the time she is accepted for the auxiliary fleet; and a rebate of 6 per cent. per annum to be made for depreciation of value.

4. Each ship is at first to be placed on the list for a period of three or five years, subject afterwards to twelve months notice.

5. When a ship is taken over for employment by the Government, it shall be for a period of not less than six months.

6. An agreed number of the crew shall at all times consist of Naval Reserve men.

7. If a ship is carrying H.M. mails when it is proposed to annex her to the auxiliary fleet, the approval of the Postmaster-General is to be obtained.

This seed, for which we had to thank Mr. Ismay, was planted at the Admiralty nine years ago.

It was recommended that £50,000 should be taken in Navy estimates for securing thirty selected ships for the year.

It was pointed out that in course of time we might hope to get in such ships twin screws; a double bottom in the centre part of the ship; better subdivision into compartments; and more breadth amidships, so as to get deeper coal-bunkers abreast of the machinery for its better protection. Under the cold shade of the Admiralty the seed has taken nine years to make any appearance, although it receives constant attention.

If it has taken nine years to put forth the feeble shoot over which we are rejoicing, when may we expect to see a robust and well-developed system?

It has needed the forcing provided by the events attending the anticipated war with Russia, and the recent action of the Post Office as to German ships, to get so much as Lord George Hamilton has announced, little as it is.

I am afraid that no Board of Admiralty can deal with this question fully and fairly. It is impossible that such a body can be trusted to find money out of the Naval Votes for what is not regarded as the Royal Navy. What I think is wanted is a Secretary of the State for the Navy, who would unite the interests of the "Merchant Shipping" and the "Royal Navy," and form a truly National Marine.

APPENDIX.

[*Extract from Statement with Navy Estimates*, 1887-88.]

UTILIZATION OF AUXILIARY RESOURCES.

The inquiries, which an Intelligence Department must needs make, brought before the Board in forcible contrast the great disproportion between the volume of floating commerce of the Empire to be protected and the force at present available to protect it, compared with the mercantile and war marine of foreign nations. To bring the British Navy and commerce into the same relative proportion as that which exists elsewhere in Europe is neither needed nor practicable. To carry out a plan which, at the approach of war, would immediately convert our fastest and most powerful merchant-vessels into effective war-cruisers, and thus turn the assailed into assailants, seemed a natural solution of the difficulty; but there were various obstacles to its realization. The cost of retainers, the difficulty of providing crews and stokers, the delay in the alterations necessary, the contingency that when wanted the vessel might be at the other end of the world—these difficulties in combination deterred previous Boards from making the experiment.

The enormous sums spent in taking up vessels in 1885, many of which never left the harbour, and the long delay in getting the guns and fittings into the *Oregon*, the only vessel thoroughly equipped of all those hired, impressed upon my colleagues and myself the duty of taking some action in the matter. Exceptional speed and strength are the only desiderata of a mercantile cruiser. It occured to us that the Post Office expenditure might be utilized, and that if we worked in combination, postal contracts could be associated with conditions by which the use of the vessels carrying the mails might under certain contingencies be economically secured to the State. The revision of the North American contract was a most favourable opportunity for a trial of the idea. The White Star Company, one of the tenderers, had, in August last, expressed their willingness to build two vessels to be approved by the Admiralty, of a speed and strength superior to any merchant-ship afloat, with engines and boilers below water, with fittings for guns built in during construction, and, when manned, with half crews of Naval Reserve men.

In return for their use, the Company requested an annual subsidy which would recoup the owners a portion of the larger outlay the exceptional construction of the vessels required.

The Cunard Company, another of the tenderers, has the fastest ships afloat. A large portion of the officers and men in the employ of the Cunard Company are Naval Reserve men. Their ships are never more than eight days distant from Liverpool, and therefore, always obtainable at short notice.

The Admiralty after full consultation with the Treasury and Post Office, commenced negotiations with these two Companies.

They were influenced greatly by this consideration, that merchant-vessels, when armed, to be really serviceable, should have exceptional speed and coal capacity, enabling them to overhaul the weak and to escape from the strong.

Such exceptional speed entails a primary cost in engines and boilers, and a consumption in coal that renders the remunerative employment of the vessel very difficult. Only a few of the richest and best-conducted passenger lines can afford to build such vessels, and the profits derived from their employment in recent years have been small.

Unless some inducement is given by the English Government to continue the building of such vessels, they must diminish in number; whereas abroad, by subsidies, their construction is directly encouraged. It is neither to the credit of the country nor for the advantage of our marine that vessels of this class should mostly be under foreign flags.

The arrangement made with the two companies differs in detail, but is the same principle.

By the payment of an annual subsidy, reduced one-fourth so long as the mail contract lasts, the Government obtain from the Cunard Company the use of the *Aurania*, *Etruria*, and *Umbria*, in time of emergency at a price fixed both as regards hire or sale. The necessary platforms and fittings for carrying guns are to be put in at once. The crews of the ships to be half Naval Reserve men; the owner to take charge of the gun mountings required. Under this arrangement, it is believed that within a week all three vessels could be fitted, armed, stored, and manned as armed cruisers. The use, at fixed prices, of the remainder of the fleet, if required, was a secondary condition of the contract.

With the White Star the arrangement was practically the same, except that no payment was to be made till the two new ships to be built were ready for sea.

By this arrangement the Admiralty have obtained, at a moderate annual cost, the use for five years of the three fastest steamers afloat, and two even faster, when constructed.

Negotiations with the Australian Colonies have for some time past been carried on, which, though not concluded, will, we hope, result in those countries contributing towards an extension of the Imperial Navy, and maintaining, as an integral part of the Fleet, an Australian squadron, in addition to the force which has hitherto been stationed in those waters.

COMMUNICATION RELATING TO THE PRINCIPLE OF AN HYDRAULIC APPARATUS FOR CONTROLLING GOVERNING POWER AT A DISTANCE.*

PAPER COMMUNICATED BY MONS. E. WIDMANN, ON BEHALF OF MONS. MARC BERRIER FONTAINE.

CONJOINTLY with Monsieur Marc Berrier Fontaine I beg the honour to submit to the Institution the principle of an hydraulic apparatus for controlling power at a distance, which we thought out together while we were engaged at the Arsenal of Toulon, and which appears to us to be susceptible of numerous applications on board ships of war.

This principle is none other than that of the transmission of pressure in a fluid mass in equilibrium. Suppose two cylinders to be filled with water, and to be connected by a pipe of any length and diameter. If we vary the interior pressure in one of the cylinders, the same variation will be produced in the other. If then we fit into each cylinder a piston, surmounted by a spring, so as to form a sort of pressure gauge, similar to a Watt's indicator, the oscillations produced on either spring by the variations of the pressure will be indentical. If we regulate these variations at pleasure, so as to bring the spring of the first cylinder, which we may call the "manipulator," to any given point, the spring of the other cylinder, which we may call the "repeater," will take up the corresponding position, and that, too, no matter what may be the distance apart of the two cylinders, or the form of the connecting pipe. There is a very simple method of varying the pressure in the manipulator, on all vessels provided with a system of water under pressure. All that is required is to put this cylinder into communication with the pressure pipe; for example, with the return pipe, by means of a "distribution box" similar to that employed by Sir William Armstrong and Mr. R. Tweddell; if, then, the lever which governs this box is joined to the spring, by means of the system of link-work with double centres, invented by Mr. MacFarlane Gray, it will be possible to bring the spring of the manipulator into any position whatever, as determined by the position which it was thought proper to give to the lever of the distribution box.

At the other end of the pipe the spring of the repeater reproduces the movement of that of the manipulator, and actuates the distribution box of the principal apparatus, by means of a system of link-work, which renders the movements of this apparatus absolutely indentical with those of the springs, and, consequently, with those of the lever on which the hand of the operator acts.

In our opinion this hydraulic apparatus is susceptible, amongst other applications, of being used to work the rudder. In this case it would have the advantage of not requiring any mechanical means of communication between the bridge and the rudder, which would get rid of a difficulty well known by all who have had to provide for mechanical transmissions of this nature on our large war ships whenever it is desirable to be able to steer from the fore part of the vessel, or even from the top.

*Read at the Twenty-eighth Session of the Institution of Naval Architects.

SOME RECENT HIGH-SPEED TWIN SCREWS.*

By E. A. LINNINGTON, Esq., Member.

ONE of the most interesting and valuable features in the development of naval construction in recent years is the great advance which has been made in the speeds of our war ships. This advance has been general, and not confined to any particular vessel, or class of vessel. From the first-class armoured fighting ship of about 10,000 tons displacement, down to the comparatively diminutive cruiser of 1,500 tons, the very desirable quality of a high speed has been provided. These are all twin-screw ships; and each of the twins is driven by its own set of engines and line of shafting, so that the propelling machinery of each ship is duplicated throughout. The speeds attained indicate a high efficiency with the twin-screws. In all ships, but more especially in high-speed ships, success depends largely upon the provision of propellers suited for the work they have to perform; and where a high propulsive efficiency has been secured, there is no doubt the screws are working with a high efficiency. The principal purpose of this paper is to record the particulars of the propellers, and the results of the trials, of several of these high-speed twin-screw ships.

The table gives the leading particulars of several classes of ships, the particulars of the screws, and the results obtained on the measured mile trials from a ship of each class, except C. The vessels whose trials are inserted in the table have not been selected as showing the highest speeds for the several classes. Excepting C, they are the ships which have been run on the measured mile at or near the designed load water-line. One light draught trials speeds have been attained from half a knot to a knot higher than those here recorded. No ship of the class C has yet been officially tried on the measured mile, but as several are in a forward state, perhaps the actual data from one of them may be obtained before this paper is bound in the "Transactions."

All these measured mile trials were made under the usual Admiralty conditions, that is to say, the ships' bottoms and the screws were clean, and the force of the wind and state of the sea were not such as to make the trials useless for purposes of comparison. On such trials the I.H.P. is obtained from diagrams taken while the ship is on the mile, and the revolutions are recorded by mechanical counters for the time occupied in running the mile. Not less than four runs are made during a trial extending over several hours. The I.H.P. in the table is not necessarily the maximum during the trial, for the average while on the mile is sometimes a little below the average for the whole of the trial. The revolutions are the mean for the two sets of engines, and the I.H.P. is the sum of the powers of the two sets. The pitch of the screw is measured. The bolt holes in the blade flanges allow an adjustment of pitch, but in each case the blades were set as nearly as possible at the pitch at which they were cast.

The particulars given in the table may be taken to be as reliable and accurate as such things can be obtained, and for each ship they are corresponding data; that is, the powers, speeds, displacements, revolutions, pitches, and other items, existed at the same time.

There are a few points of detail about these propellers which deserve a passing notice. In Fig. 1 is shown a fore and aft section through the boss. It will be observed that the flanges of the blades are sunk into the boss, and that the bolts are sunk into the flanges. The recess for the bolt heads is covered with a thin plate having the curve of the flange, so that the flanges and the boss form a section of a sphere. This method of construction is a little more expensive than exposed flanges and bolts; which, however, render the boss a hugh churn. With the high revolutions at which these screws work a spherical boss is extremely desirable, but of course the details need not be exactly as shown in the illustration. The conical tail is fitted to prevent loss with eddies behind the flat end of the boss, and is particularly valuable with the screws of high-speed ships. The light hood shown on the stern bracket is for the purpose of preventing eddies behind the boss of the stern bracket, and to save the resistance of the flat face of the screw boss. The edges of the blades are cast sharp, instead of being rounded at the back, with a small radius, as in the usual practice; the object of the sharp edge being the diminution of the edge resistance. The driving key extends the whole length of the boss, and the tapered shaft fits throughout its length. These points of detail have been features of all Admiralty screws for some years.

*Read at the Twenty-eighth Session of the Institution of Naval Architects.

The frictional resistance of screw propellers is always a fruitful source of inefficiency. With a given screw the loss due to friction may be taken to vary approximately as the square of the speed. This is not to say that the frictional resistance is greater in proportion to the thrust at high than at low speeds. The blades of screws for any speed should be as smooth and clean as possible, but for high-speed screws, the absolute saving of friction may be considerable with an improvement of the surface. There is no permanent advantage in polishing the blades. No doubt there is some advantage for a little time, and probably better results may thereby be secured on trial, but the blades soon become rough, and shell fish and weed appear to grow as rapidly on recently polished blades as on an ordinary surface. These screws are of gun-metal; they are fitted to the ship in the condition in which they left the foundry.

It appears that within certain limits mere shape of blade does not effect the efficiency of the screw, but with a given number of blades and a given disc, the possible variations in the form or distribution of a given area are such that different results may be realized. The shapes of the blades of these propellers are shown in Figs. 2, 3, 4. It will be seen the shapes are not exactly the same for all the screws, but the differences do not call for much remark. Fig. 2 shows the blades for the A screw; C and D have the same form. Fig. 3 shows in full lines the blades of the B screw, and, though very narrow at the tips, they, like A, are after the Griffith pattern. The blades of E and F are of a similar shape, as shown in Fig. 4, and approach an oval form rather than the Griffith pattern.

The particulars of these propellers would be considered incomplete without some reference to their positions with respect to the hulls. When deciding the positions of twin screws, there is room for variation, vertically, longitudinally, and transversely. For these screws the immersions inserted in the table give the vertical positions. The immersion in A is 9 ft. showing what may be done in a deep-draught ship with a small screw. Whatever the value of deep immersion may be in smooth water, there can be no question that it is much enhanced in a seaway. The longitudinal positions are such that the centre of the screw is about one-fifth of the diameter forward of the aft side of the rudder-post. The positions may, perhaps, differ somewhat from this rule without appreciably affecting the performance; but if any alteration be made it would probably be better to put the screws a little farther aft rather than forward. The forward edges of the blades are from 2 ft. to 3 ft. clear of the legs of the bracket which carries the after-bearing.

The transverse positions are decided to some extent by the distance between the fore and aft centre lines of the engines. As regards propulsive efficiency it would appear that the nearer the screws are to the middle line, the less is the resistance due to the shaft tubes and brackets, and the greater is the gain from the wake in the screw efficiency; but, on the other hand, the greater is the augment of the ship's resistance due to the action of the screws. Further, the nearer the screws are to the hull the less are they exposed, but experience is not wanting to show that the vibration may be troublesome when the blades come within a few inches of the hull. Instead of balancing these considerations, it is more satisfactory to state that the average of the clearances between the tips of the blades and the respective hulls is about one-eighth of the diameter of the screw.

An interesting and noteworthy fact in connection with these propellers is the wide differences in the pitches and revolutions, though the products of the two do not greatly vary. Such differences are extremely rare in the mercantile marine for similar speeds, but in war ships they are inseparable from the conditions of the engine design. As a general rule, with (revolutions × pitch) a constant, and increase of revolutions and the consequent decrease of pitch allow a diminution of disc and of blade area; other modifying conditions such as the thrust, slip number, and pattern of blades being the same.

The screws for E and F are interesting, because with practically the same speeds and slips there is a considerable difference in the revolutions. It will be observed that F is a vessel of finer form and a little less displacement than E, and therefore has the less resistance. Although E has the greater resistance and the screw the smaller $\frac{\text{pitch}}{\text{diameter}}$, the higher revolutions permit the use of a smaller screw; but from this example the influence of the high revolutions in diminishing the size of screw does not appear so great as some empirical rules would indicate. The screws for A and B are also worthy of attention. Although the ship A has a much greater resistance than B, the screw of the former is much

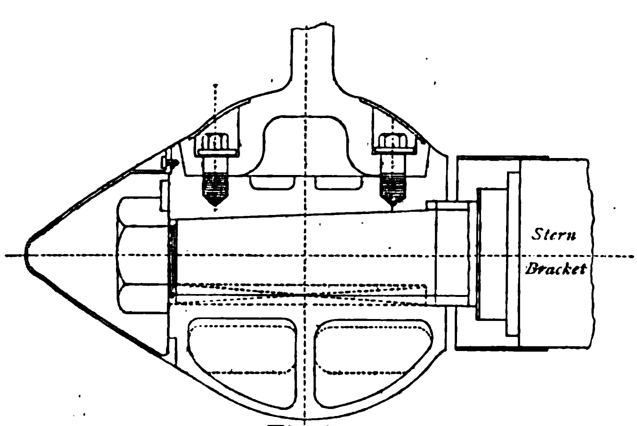


Fig.1.

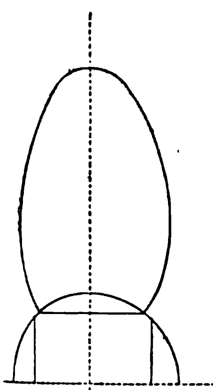


Fig.2.

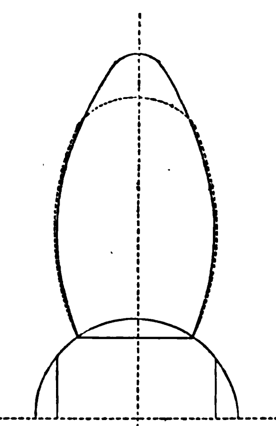


Fig.3.

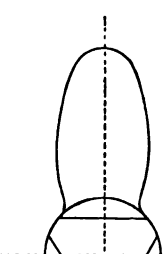


Fig.4.

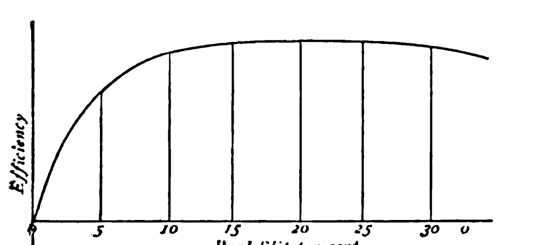


Fig.5.

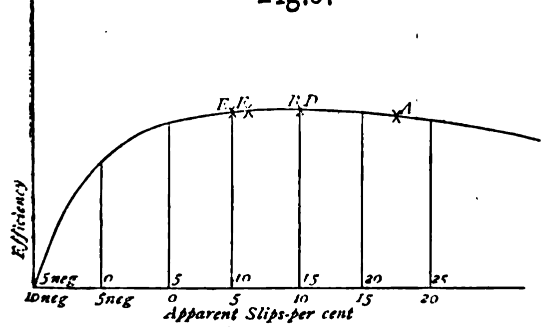


Fig.6.

SOME RECENT HIGH-SPEED TWIN-SCREWS.

the smaller both in the blade area and the disc. A's screws, however, in addition to 22 per cent. more revolutions than B, have a much larger slip, and the blades have rather a fuller form at the tips.

Compared with the practice in the mercantile marine, the revolutions of these screws are very high, and from the foregoing remarks it may appear that much larger screws would be required for a merchant ship than for a war ship of the same displacement and speed. There would, however, be several items favourable to the use of small screws. For a given displacement the resistance would be less in the mercantile ship, and with the lower revolutions the proportions of blade area to the disc could be increased without impairing the efficiency. Thus in passing from the war vessel to a merchant ship of the same displacement, there are the lower revolutions favourable to a larger screw, but, on the other hand, the smaller resistance, larger proportion of blade area, and the coarser pitch, are favourable to a diminution of the screw. The ship B has a very large screw at 88 revolutions, but the tips are very narrow. If the blade were as dotted for a diameter of 16 ft., the same work could be done with the same revolutions, but with a little coarser pitch and a little more slip.

There is something to be said for large screws with a small proportion of blade area to disc. For instance, two-bladed screws have frequently given better results than four-bladed screws of smaller diameter; neglecting, of course, the question of vibrations. Twin-screws, however, should as a rule be made as small as possible in diameter without loss of efficiency. The advantages of small twin-screws are the shorter shaft tubes and stern brackets, deeper immersion, and less exposure as compared with large screws. The exposure of the screws is usually considered an objection, but perhaps too much has been made of it, for those well qualified to speak on the subject consider that careful handling of the ship would, in most cases, prevent damage to the screws, and that where the exposure is unusually great, effectual protection by portable protectors presents no insuperable difficulty.

The slips of these screws vary from 10 to 17½ per cent., which is certainly not an extensive range, considering the widely different working conditions. Slip, as an indication of the efficiency of the screw, is not only an interesting subject, but it is often one of importance. In these ships, however, there is nothing about the slips which would give rise to any doubts as to the fitness of the screws for their work. I should like to say a few words upon this slip question, though an adequate treatment of it would require a separate paper of considerable length.

The ancient fallacy that small slip meant a high screw efficiency was supported by the great authority of the late Professor Rankine. Experience proved that considerable slips and efficient screws were companions. The late Mr. Froude offered an explanation of this general rule in a paper read before this Institution in 1878, and gave a curve of efficiency with varying true slip. In Mr. R. E. Froude's paper last year there was a form of this curve, with an arbitrary abscissa scale for the slip, devised to illustrate in one diagram the wide conditions covered by his experiments. In the screws now under consideration the values of the $\frac{\text{pitch}}{\text{diameter}}$ vary only from 1·2 to 1·34, and for these the abscissa values for the same slips do not differ much. Taking the mean value and bringing the slips to a common scale, Fig. 5 is obtained, which would approximately represent the relation between the efficiency of any one of these screws and its true slip, if this curve were applicable to full-sized screws propelling actual ships.

The slips in Fig. 5 being real or true, are not the slips of commerce, which are the apparent slips such as those given in the table. Let us endeavour to split up these real slips into the apparent slips and another item, the speed of the wake. We then at once meet with the difficulty that the wake in which the screw works has not a uniform motion. Complex, however, as are the motions of the wake, the screw may be assumed to work in a cylinder of water having such a uniform forward velocity as will produce the same effect as the actual wake on the thrust of the screw. It is then readily seen that the real slip is the sum of the apparent slip and the speed of the hypothetical wake. To make this clear, let v be the speed of the ship, v_s the speed of the screw, *i.e.*, revolutions × pitch, and v_w the speed of the wake: then—

Apparent slip $= v_s - v$.

Real slip - $= v_s -$ speed of ship with respect to the wake.

,, - $= v_s - (v - v_w) = (v_s - v) + v_w$

,, - $=$ Apparent slip $+$ speed of the wake.

If the apparent slip be zero, the real slip is the speed of the wake; and if the apparent slip be negative, the real slip is less than the

speed of the wake. The real slip is greater than the apparent slip, and can never be a negative quantity.

From Mr. Froude's model experiments it appears that this speed of wake for the A class of ship amounts to about 10 per cent. of the speed of the A screw. If this value is correct, then the real slip is (10 + 17·6) per cent., or 27·6 per cent. This is shown in Fig. 6, where O is the point of no slip, being 17·64 from the point of real slip. Slips to the right of O are positive apparent slips; slips to the left are negative apparent slips. The vessel F would certainly have a wake with a speed considerably less than that of A's wake. From the model experiments the wake for F is about one-half that for the A class, or, roughly, 5 per cent. of the speed of the screw. For the ship F, O′ is the point of no apparent slip, and the real slip is (5 + 11·4) or 16·4 per cent. For E, the point of real slip is approximately the same as for F. For B and D, the positions on the curve would be about the same. The slip B has a higher speed of wake than D, but the screw D has the greater apparent slip. The influence of the number of blades on the scale for the slip has been neglected.

If this efficiency curve were applicable to full-sized screws propelling actual ships, and if the determination of the wakes were beyond question, then we should have a proof that our screws were at or near the maximum efficiency. But as we know from the total propulsive efficiencies that the screws have high and not widely different efficiencies on these ships, we may argue the other way, and say that there is good reason to consider that at least the upper part of the curve agrees with experience obtained from actual ships.

Now take Fig. 6 and consider the general laws there represented. Take the speed of the wake as 10 per cent. of the speed of the screw, which is probably an average of widely different conditions, including many single as well as twin-screw ships. Then this curve shows that considerable negative slips mean inefficient screws; that screws may have very different positive slips without any appreciable difference in their efficiencies; and that very large positive slips and inefficient screws may be companions; for instance, a screw with a large positive slip in smooth water is frequently inefficient at sea against a head wind, which increases the resistance and necessitates an increase of slip. I venture to say that these statements, taken in a general manner, are not at variance with experience obtained from the performances of screw ships.

Before it is possible to satisfactorily decide if this curve applies in a general manner to full-sized screws propelling ships, we require the results of trials of various ships where the screws are working about the region of no slip. Model experiments teach that the scale for the slip varies with the design of the screw, and that with a given screw the speed of the wake (which decides the point of no apparent slip) varies with the type of ship and with the position of the screw with respect to the hull. Remembering these disturbances, it is not improbable that it may be possible to account for or explain what at first sight may appear departures from the curve.

The diameters of the screws in the table are not compared with the diameters given by the method explained by Mr. Froude in his paper last year; for there are differences in the slips, the proportions of blade area to disc, and to some extent in the shapes of the blades, which are not taken into account in that method. Assuming, however, as Mr. Froude does, a constant proportion of blade area to disc and a uniform pattern of blade, the determination of the diameter for a given set of conditions may, as a rule, be a complete solution of the problem of the design of a screw; but these assumptions do not cover all the necessities of actual practice, which make it extremely desirable to know something about the influence on efficiency of various proportions of blade area to disc, and of the form or distribution of a given area.

At the present time the engineer who designs a screw propeller depends mainly on information such as that given in the table, and as published data of this nature are somewhat rare, I hope the paper will be interesting to the Institution generally, and useful to those members who may have to design the screws of high-speed ships.

PARTICULARS OF SOME RECENT HIGH-SPEED TWIN SCREWS.

SHIP	A	B	C	D	E	
Length, feet	325	315	300	300	220	250
Breadth, feet	68	61	56	46	34	32½
Draught on Trial, Forward	26ft. 2in.	24ft. 6in.	..	15ft. 6in.	12ft. 10in.	13ft. 1in.
Draught on Trial, Aft	27ft. 3in.	25ft. 6in.	..	19ft. 9in.	15ft. 2in.	14ft. 7in.
Displacement, tons	9,690	7,645	5,000	3,584	1,560	1,544
I.M.S., square feet	1,560	1,287	1,000	744	438	392
Speed of Ship, knots	16·92	17·21	18·75	18·18	16·91	17
I.H.P.	11,610	10,180	8,500	6·160	3,115	3,045
Revolutions, per minute ..	107·2	88	120	122·6	150·4	152·1
Pitch of Screw	19ft. 5in.	22ft.	18ft. 9in.	17ft. 6in.	12ft. 7½in.	14ft. 9in.
Slip, per cent.	17·6	10	..	14·2	9·7	11·4
Diameter of Screw	15ft. 6in.	18ft.	14ft. 6in.	13ft.	10ft. 6in.	11ft.
Diameter of Boss	4ft. 4in.	4ft. 11in.	3ft. 9in.	3ft. 5in.	2ft. 9in.	2ft. 10in.
Number of Blades	4	4	3	3	3	3
Blade Area of one Screw ..	72	87	60	47	24	24
Shape of Blade	Fig. 2	Fig. 3	Fig. 2	Fig. 2	Fig. 4	Fig. 4
$\frac{\text{Pitch}}{\text{Diameter}}$	1·25	1·22	1·3	1·34	1·2	1·34
$\frac{\text{Disc}}{\text{Blade Area}}$	2·62	2·92	2·75	2·82	3·6	3·96
Immersion of Screw	9ft.	5ft. 3in.	..	4ft. 4in.	2ft. 9in.	1ft. 10in.

LAUNCH OF H.M.S. "VICTORIA."

ON April 9th the armourclad war ship *Victoria* was launched from the Elswick yard of Sir W. G. Armstrong, Mitchell and Co., Newcastle-on-Tyne, by whom she has been built for the English Government. Originally it was intended that the vessel should be named the *Renown*, but this was afterwards altered and the name *Victoria* given to her instead, in honour of the Queen's jubilee. The first rivet in the *Victoria* was driven by Sir William Armstrong in June, 1885, so that she has been nearly two years in building, and nearly a similar period will have to elapse before she is ready for delivery. She will then, however, be in perfect fighting order the firm which has built the vessel also providing her with all her armaments and machinery; this, we believe, being the first instance in which a war ship has been built and made ready for the reception of her crew by a single firm. The *Victoria* will be one of the largest ironclads in the British Navy. Her dimensions are:—Length, 340 ft.; breadth, 70 ft.; mean draft, 25 ft. 9 in.; displacement in tons, 10,500; H.P., 12,000. She is protected by armour 18 in. thick, and is armed with two 110-ton guns, one 30-ton gun, 12 five-ton guns, 12 six-pounder quick-firing guns, nine three-pounder quick-firing guns, besides machine-guns for smaller ammunition. She also has a powerful ram and eight torpedo dischargers. The *Victoria* being the heaviest vessel ever launched off the Tyne, the proceedings were witnessed by about 150,000 persons, who took up positions on both sides of the river, and even on the Redheugh-bridge, half-a-mile away, for the purpose of witnessing the monster craft as she took to the water. Among those in the Elswick yard were Sir W. G. Armstrong, Mr. Forwood, M.P. (Secretary to the Admiralty) and Mrs. Forwood, Lord Charles Beresford, M.P. (Lord of the Admiralty), Mr. W. H. White, (Director of Naval Construction), Captain Noble, Mr. and Mrs. W. D. Craddas, the Mayor of Newcastle (Mr. B. C. Browne) and Mrs. Browne, the Vicar of Newcastle (Canon Lloyd), Canon Franklin, Canon Bromley, Colonel Potter, C.B., Captain Chapman, Professor Garnett, Mr. P. J. Messent, and several aldermen and councillors of Newcastle. The religious service with which the proceedings began was conducted by Canon Lloyd, who read the 107th Psalm and three short prayers. The vessel was then launched by Mrs. Forwood, who, as she touched the apparatus for liberating the ship, christened her the *Victoria*, amid great cheering. The launch of the heavy vessel had the effect of throwing up a large wave on to the opposite bank of the river, where several people received a severe wetting, while not a few were knocked down by the force of the water. After the launch, the invited spectators adjourned to the mould loft, where refreshments were served.

SIR WILLIAM ARMSTRONG proposed the toast of "The Queen," after which he gave "The Royal Navy and success to Her Majesty's ship *Victoria*." He said: The launch of to-day will be a memorable event in the history of Elswick, not only because the *Victoria* is the first armourclad that the company has built, but because she is the heaviest ship ever successfully launched in this country, for which reason the operation of launching was regarded as unusually critical. For my part it was a great relief to see her safely in the water, and I trust her successful launch will be the commencement of a successful career. She has been honoured with the name of *Victoria*, which, in this Jubilee year, confers a high distinction on the ship, and she has been launched under the auspices of a lady who, I trust, will be as well satisfied with the success of the operation as all spectators must have been with her efficient performance on the occasion. I am about to propose a toast, but before I do so I will take the present opportunity of making some remarks concerning the *Victoria* and war ships in general. This is not a fitting occasion for me to criticise the policy of strengthening our fleet by the adoption of great armourclads rather than by the addition of swift cruisers of the protected class. I have said enough on this subject on many former occasions, and I will now only observe that I am glad to see that our Admiralty are disposed to slacken their expenditure on these gigantic ships in response to similar action on the part of other maritime Powers, and that they are expanding their operations in the building of swift cruisers. I maintain, as I have always done, that this country requires above all things a numerous fleet of swift cruisers, not extemporized out of merchant or passenger ships, but specially built and adapted for the protection of the widespread commerce upon which our very existence depends, and for aiding in the defence of our Colonies, which I trust will every year draw closer to the mother country. But what I chiefly wish to do on this occasion is to direct your attention to the marvellous transformation which has taken place within the last 40 years in our ships of war and their armaments, and the enormous increase of efficiency which has been attained thereby. In an æsthetic point of view it must be confessed our ships have sadly deteriorated. No more beautiful object could be seen than a great man-of-war of the old type under a press of sail. Poets and painters have delighted in depicting it. But the engineer appreciates power more than beauty, and while a Ruskin would stigmatize a modern war ship as a "devil" ship, the engineer regards it as a splendid triumph of mechanical skill. For the purpose of comparison between ships of the old sort and the new I can take no more fitting examples than the *Victory* and the *Victoria*, so like in name and yet so different in all things else. The *Victory*, I need hardly say, was the famous line-of-battle ship in which Nelson fought and died. She was one of the largest ships of her day, but her displacement or total weight with everything on board was only 3,500 tons, while the displacement of the *Victoria* will be 10,500 tons. The *Victory*, in accordance with the usage of the time, was built of oak. The *Victoria*, in accordance with the present practice, is built of iron. The *Victory* was propelled by wind, over which man has no control. The *Victoria* will be propelled by steam, over which man has perfect mastery. The *Victory* had the character of being an extraordinary quick sailer, and when the wind in its vagaries happened to be exceptionally propitious she could attain a speed of nearly 13 knots an hour. The *Victoria* propelled by engines of more than 12,000 H.P., may be expected to achieve about 17 knots an hour, and will be independent of the wind. In regard to armament the comparison in favour of the *Victoria* is astounding, and ought to open the eyes of those who are in the habit of disparaging the progress of artillery in this country. The armament of the *Victory* as she fought at Trafalgar consisted of 30 32-pounders, 30 24-pounders, 40 12-pounders, and two 68-pounder carronades, making in all 102 guns. The heaviest of these guns was under three tons, while the heaviest on board the *Victoria* will be 110 tons. The largest charge of powder used on the *Victory* was 8 lbs., while the largest charge to be used on the *Victoria* will be 900 lbs. The heaviest shot used in the Victory was 68 lb., while in the *Victoria* it will be 1,800 lbs. The weight of metal discharged from the broadside of the *Victory* was 1,150 lbs., against 4,750 lbs. from that of the *Victoria*. But the power of the broadside discharge of each ship is better indicated by the quantity of powder expended than by the weight of metal discharged, and while the broadside fire from the *Victory* consumed only 325 lbs., that from the *Victoria* will consume 3,000 lbs. In point of range, accuracy, penetrating power, and shell power, the difference is so great in favour of the *Victoria* that a comparison would be ridiculous. I have yet to give you the particulars of the *Victoria's* armament. It will consist of two 110-ton guns, mounted on a revolving turret and firing ahead or on either side; 12 five-ton guns, 12 six-pounder quick-firing guns, and nine three-pounder quick-firing guns, and a considerable number of machine guns for smaller ammunition. Besides her artillery armament the *Victoria* has a powerful ram and she carries eight torpedo dischargers—four above water and four below water. In the fighting days of the *Victory* ramming was little practised and torpedoes were wholly unknown. Therefore in these respects no comparison can be drawn. But there is another point of view in which the *Victoria* compares in a highly favourable degree with the *Victory* and that is in the smallness of the number of officers and men required to handle and fight the ship. The complement of officers and men on board the *Victory* was 850, while on board the *Victoria* it will only be 550, of whom 110 will be engineers and stokers, leaving only 440 officers and men in a combatant capacity. Thus although the *Victoria* is three times as big as the *Victory*, and prodigiously superior in offensive power, there will only be half the number of men exposed to death and wounds in the working of her armament. This result is chiefly due to mechanical appliances which in recent years have been introduced for working the guns. At the commencement of my career as an artillerist it was regarded as an axiom that no gun exceeding 5 tons weight could be worked on a moving platform such as the deck of a ship. A gun of 5 tons 12 cwt., firing a charge of 20 lbs. of powder and a shot of 68 lbs., has been tried on shipboard and found unmanageable, and it had to be replaced by a gun of 4 tons 15 cwt., firing only 16 lbs. with the same weight of shot. At the present day we have to deal with guns of 110 tons, which have to be charged with powder and shot weighing together 2,700 lbs. It is manifest that the loading and manipulation of such a gun could not possibly be effected by the manual labour of any number of men that could be crowded around the gun, but it has been effected by the employment of a very few men acting

through the agency of hydraulic machinery invented and reduced to practice by the former Elswick Company and largely covered by patents now vested in the present company. Then, again, to go from the largest to the smallest artillery gun to be used in the *Victoria*, which is the 3-pounder Hotchkiss quick-firing guns, we have another example of what mechanicians have done for artillery. It is a gun of great range and penetrative power, which by means of mechanical arrangements can be fired with deliberate aim 20 times a minute by the employment of only three men. Or, if we take the quick-firing gun which has recently been designed and perfected at Elswick, and which fires any desired weight of projectile between 30 lbs. and 40 lbs., and compare it with the old 32-pounder such as the *Victory* carried, and which required eight men to work it at the rate of one round a minute, we have in the new weapon a gun of enormously greater power, which can fire ten rounds a minute with only four men to serve it, so that this gun with four men to serve it will fire as many rounds per minute as could formerly be fired by 80 men with ten guns. But while admitting, as all must do, the vast superiority of modern war ships over those which preceded them, you will probably say, "Look at their enormously greater cost and the burdens they impose upon the taxpayers." Now, I think there is a great deal of fallacy about the impoverishing effect upon the nation of this increase of cost; every penny spent upon ships of war is spent in the country, and every article used in their construction is derived from the natural resources of the country. The nation, taken as a whole, pays for its ships out of one pocket and receives the money into the other, and I do not see that it is much the worse for the operation. Much is said about the difference between productive and non-productive expenditure, but I fail to see how expenditure on warships can be called unproductive when we gain by it protection from aggression on our coasts, our colonies, and our commerce. As well might we say that the vast expenditure on the piers at the mouth of the Tyne was unproductive, because we had nothing to show for it beyond the protection of our merchant ships from the violence of the sea. War ships are needed to protect us from the violence of our enemies just as piers and breakwaters are needed to protect us against the violence of the sea, so that the economic aspect is the same in both cases. At all events men want work in every department of industry, and additional outlay in any one department ramifies in every direction and indirectly benefits every other branch of industry. But I must not digress into political economy, but proceed to the main object of my rising, which is to propose the toast of the Royal Navy and success to the *Victoria*, coupled with the health of Mr. Forwood, the Parliamentary Secretary to the Admiralty.

Mr. A. B. Forwood, M.P., responded, and contrasted the state of the Navy 50 years ago with its condition to-day. The figures he quoted ought, he said, to bring home to the people of the country the necessity of the expenditure that the country had at present to meet, and the necessity of maintaining our Navy at the highest point of efficiency compared with the navies of other nations. He learned that the new vessel could remain at sea, at a high speed, for a distance of something like 5,000 knots, or very nearly the distance from here to New York and back. While he believed it was necessary to keep the naval dockyards fully employed, he approved the system of allowing the extra vessels to be built by the private firms of the kingdom. He concluded by proposing "Success to the Elswick Firm."

Sir W. G. Armstrong replied, and stated that the firm had recently completed a swift cruiser for a foreign Government, which, on being tried, attained the speed of 19½ knots an hour, and was thus the swiftest cruiser afloat.

A New Spanish Squadron.—The Minister of Marine will shortly be open to receive estimates from foreign shipbuilding yards for the construction of 21 cruisers of different sizes, 160 torpedo vessels, and the supply of a large quantity of naval material, in order to create the new squadron recently authorised by the Cortes. The Statute under which the Minister is acting authorises him to spend eleven millions sterling in nine years. Spain possesses no private yards capable of carrying out such an enterprise. Her Royal arsenal can only build smaller craft, so she has to appeal to foreign builders. French, Germans, and Austrians are already making offers; but in naval circles it is considered most probable that the majority of the vessels will be built in England, the Spanish Admiralty having been satisfied with several vessels built by our leading yards. The war stores, guns, and plates will be bought from French firms.

RETORT MANGANESE STEEL.

At the invitation of the inventors and sole manufacturers, Messrs. Pfeil & Co., of 145, St. John Street, Clerkenwell, London, we recently inspected some samples of this remarkable metal, and at the same time had the pleasure of seeing some practical tests made with it.

The great advantage of retort manganese steel is its absolute uniformity of quality; hence no engineer in future need fear to specify the use of steel, whereas in the past the erratic behaviour of steel was a constant source of doubt as to what would be the result if it were used in certain cases where, but for this doubt, it would have been unhesitatingly specified. Now, however, as Messrs. Pfeil and Co. guarantee that every bar of this steel made by them is capable of being welded, case-hardened, or forged with absolute certainty and uniformity, as regards results there need be no fear in specifying it to be used. In a test made by Professor Kennedy two precisely similar hooks, one made of the retort manganese steel and the other of "S. C. Crown" Staffordshire iron, by one of the best makers, were linked together, and then pulled open against each other. When tested to a load of eight tons, both hooks opened out equally; after this load had been reached the iron hook opened out much the faster of the two, and at 11·7 tons it opened out altogether, cracked, and drew off, while the steel hook had only opened about 2½ inches, but was not otherwise distressed. This was a severe and satisfactory test, but we are inclined to think that the tests which we personally saw made were of a still more crucial nature. These consisted of a number of cold bending tests made with various studs, bolts, etc., and in their results fairly surprised us. A stud bent on the threaded part nearly double showed no signs whatever of fracture, while the threads on the inner side of the curve closed up on each other till they presented an almost unbroken or continuous surface. It is thus evident that no blow or jar however severe could injuriously affect this metal, and we are of opinion that if it were more generally used for crank and propeller shafts breakdowns would be less frequent.

As a further proof of its tenacity we may state that when tested to destruction a ¾-inch bolt showed a breaking strength of 24·55 tons per square inch, with a contraction in area of 66·5 per cent., and an extension in length of 33 per cent. We were also shown bars, round and square, respectively 1½ in. diameter and 1½ in. on the side, which had been doubled, and the sides hammered flat over on each other cold, and this without the slightest sign of fracture.

After a very severe test of bolts and nuts made of manganese steel in the carriage department of the Royal Arsenal, Woolwich, they have been finally adopted there. They are also being used in the Royal Dockyards, as well as by torpedo-boat builders and others.

Its uniformity of quality, great strength, and still greater toughness give to retort manganese steel an almost limitless field of application, while its price is so low as to make it from this point of view alone a formidable competitor with ordinary iron.

Tuck's Triple Packing.—The H.P. glands of the triple expansion engines of the s.s. *Haitan*, whose trial trip we noticed in our April number, are packed with Tuck's Triple Packing, and give every satisfaction.

A POWERFUL SET OF STEAM STEERING MACHINERY.

THROUGH the courtesy of the makers, Messrs. Davis and Co., Limited, Garford Street, E., we were recently afforded an opportunity of inspecting under steam a very fine and powerful set of steam steering machinery, built by them for an ironclad of 10,800 tons, belonging to the Black Sea fleet of the Russian Government.

This is a duplicate in every respect of a similar set of machinery completed by these well-known makers only a few weeks ago for another ship of the same fleet, and these two sets are probably the largest and most powerful pieces of machinery of their kind that have hitherto been constructed.

In this case the machinery, which will be placed in the after compartment, comprises three methods of steering: namely, two sets of hand gear and one set of steam gear. These, however, are interchangeable, and steam or hand power may be brought to bear as required, while the gear is so arranged as to allow of steering being effected from different stations in the ship. An auxiliary wire rope hand steering gear is also provided for use should all the other means be put *hors de combat.* The steam gear is of Messrs. Davis & Co.'s well-known type, which has been previously described in our pages. They have, however, introduced a new form of sprocket wheel in these large sets by which greatly increased power over the chains is obtained, and this, too, with less liability of injury to the chains; the chains are also caused to pass under adjustable roller guides, by which any slack can be readily taken up.

Messrs. Davis & Co.'s name is a sufficient guarantee that even with these large gears every point has been studied so as to get the maximum of efficiency in the minimum of space, and needless to say, materials and workmanship are of the very best throughout; indeed, one could hardly expect otherwise from a firm who are makers to most of the foreign Governments as well as to our own Government, for which latter they have in hand a very fine set of gear for the Australian cruiser *Galatea*, now building at Messrs. Napier's. The gear which we recently saw has, we understand, been inspected by the representatives of the leading naval powers, and in every instance its working called forth expressions of unqualified praise.

THE Italian torpedo destroyer *Tripoli*, built at the Government dockyard at Castellamare, was run on a trial trip in the Bay of Naples on March 24th, for a distance of 50 miles. This vessel has three separate engines, driving triple screws. The average speed attained was 23 knots, and at one time 24 knots was reached, with a pressure of 130 lbs., mean revolutions 380, and H.P. developed 3,800. The engines have been built by Messrs. Hawthorne, Leslie & Co., of Newcastle.

LAUNCHES AT SEACOMBE.—On April 7th No. 12 barge, 55 ft. by 9 ft. 6 in. by 4 ft. 6in., constructed to carry 50 tons cargo on 3 ft. 6 in. draft when loaded; April 13th, *Dayspring*, steam launch, built of steel, 55 ft. by 10 ft. by 5 ft., built to attain a speed of 10 knots per hour; April 22nd, No. 13 barge *Walter*, sister craft to No. 12 barge. These vessels have been successfully launched during the month by Messrs. J. F. Waddington & Co., Seacombe, and we are glad to learn that the energy displayed has met with a good share of success, they having at present in hand a new ferry steamer for traffic on the river Mersey, the order being secured after severe competition, two steam launches, &c.

TYZACK'S IMPROVED PATENT STOCKLESS ANCHOR.

THE accompanying illustrations show the latest development of this well-known anchor. The larger illustration shows an anchor constructed on these lines

housed, while the smaller figure shows the anchor generally. From the latter it will be seen that a novel departure has been made in the construction of this anchor,

in that it is provided with three instead of the usual two holding arms, the third arm being a central one, designed to steady the action of the anchor and prevent its rolling

over, while at the same time materially increasing its holding power. This central arm is of the much approved "Trotman" type, having Roger's pawls at each extremity, and working at the same angle and upon the same axis as the two ordinary arms, thus forming a central pivot upon which the anchor can swing, and from the fact that when holding, one pawl is always pressing upon the shank, it follows that the greater the strain upon the pawl the firmer is the anchor forced into the ground. The anchor rests upon the points of three pawls, somewhat in the shape of a triangle, and being thus held in a rigid upstanding position is always ready to bite.

As seen by the larger illustration, the above new patent anchor is well adapted to work into Mr. Tyzack's system of carrying anchors in hawsepipes, and when recently submitted by the patentee, Mr. George Tyzack, of South Shields, to Lloyd's Committee, that Society gave their unqualified approval of these anchors for all vessels classed under their rules. We have much pleasure in thus briefly bringing under the notice of our readers Mr. Tyzack's latest improvements in anchors, which for quality of design, workmanship, and materials leave nothing to be desired.

LITTLE & HALE'S PATENT TELEGRAPHIC, LIGHTSHIP, ANCHOR, AND CONNECTIONS.

We need scarcely point out to our readers the manifold advantages that would accrue from a thorough and reliable telegraphic communication being established between the land and the outlying lightships, and though this at first sight seems quite a simple matter, it has hitherto baffled all attempts at a practical solution.

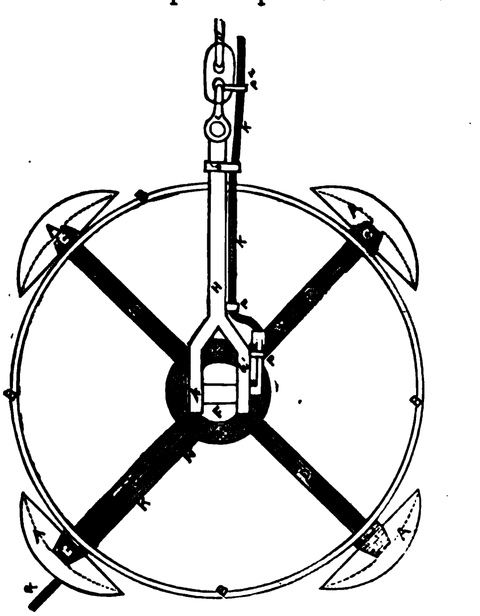


Fig. 1.

When it is borne in mind that any means taken to place a lightship in electrical communication with the shore must comply not only with the requirements of the mariner and the engineer but also with those of the electrician, it will be seen that any method to be successful must be the product of their joint labours.

It is the opinion of many experienced authorities who have examined Messrs. Little & Hale's apparatus that it fully complies with all the requirements of the case, and, judging from the very powerful and efficient provision that is made for mooring and the ample means that are made for providing and maintaining electrical continuity, we are of opinion that it will successfully accomplish what is claimed for it.

As will be seen from Fig. 1, which represents the telegraphic lightship anchor in plan, it consists essentially of four large mushroom anchors, A A A A, united together by their shanks, D D D D, terminating in a central boss E, made sufficiently massive to allow of a spindle, F, working

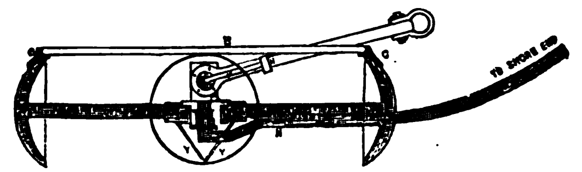


Fig. 2.

within it. The mushrooms are provided on their upper edges with clamps, C C C C, which are forged on to a crinoline or fender, B. The spindle F is made with stout shoulders or collars on its upper and lower parts so as to prevent any vertical motion. The upper extremity of the spindle terminates in two trunnions, on which is fixed the crosshead of the stock H. This stock is capable of motion in a vertical plane, and is prevented from fouling any of the mushrooms by the fender B, as shown in section by Fig. 2. It will thus be seen that any force

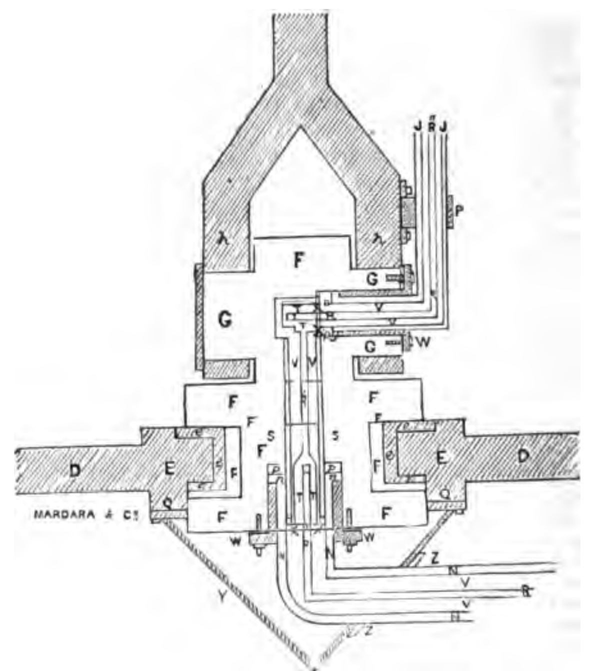


Fig. 3.

applied to the shackle L on the stock H will cause the stock to align itself to the pulling force, so obviating any danger of the cable fouling the anchor; while by jacketing and lining all rubbing surfaces with phosphor bronze, sticking through oxidation is practically overcome, and all chance of grit working up from underneath is prevented

by the conical shield bolted on the underside of the boss E. From these figures it will be seen that the telegraph cable K is led from the shore, and, passing through a hole in the crown of one of the mushrooms, is then enclosed, or rather terminates, in a strong iron pipe N, clamped to the shank D, and bent to conform with the contour of the boss, to which it is also secured.

From figure 3, a vertical section of the boss and spindle, it will be seen that the pipe N, carrying the insulated conductor, enters the shield Y, and is here secured by the flange Z to the shield. The pipe is then bent at a right angle, and passes vertically upwards through the centre of the spindle F. The pipe N is made with a collar or shoulder *n* on its extremity, and is prevented from being withdrawn, and is made watertight with the gland W. The end of the pipe butts against a series of india-rubber packing rings, which are compressed as the gland is screwed up, and should any strain cause the spindle to be lifted, the packing expands and so prevents any leakage. A brass pipe S, fixed in the centre of the spindle F, terminates inside the pipe N, and carries the copper conductor R′, which is square in section and surrounded by hard vulcanite V. This conductor terminates at its lower end in a cup-shaped form, T, of circular section internally, in which is placed the conductor R in the pipe N. These two conductors can revolve the one within the other, and to better secure good electrical contact a small spring of hardened copper wire, with two discs of copper at its ends, is placed in the space between the end of the conductor R, and the bottom of the cavity T T. By this means horizontal motion of the spindle is provided for, while any vertical motion of the stock H is provided for by a similar arrangement carried from the centre of the spindle F, through the trunnion G. The upper part of the conductor R′ terminates in a cup-shaped form T′ T′ which carries within it the conductor R″. The trunnion G G carries the gland W′, which secures and renders watertight the pipe J J. This pipe conforms to the shape of the stock, and is secured to it by the clamp P. The means for taking the turns out of the cable are shown at Fig. 3. This is the patent "Heart and Crown" swivel, of which Fig. 4 is a vertical section. The end of the ordinary cable link is made to terminate in the manner shown at B, around which can turn the crown-shaped swivel A. The spindle B is hollow, and through it is carried the insulated conductor N, which terminates in a cup-shaped form in which is carried the conductor of the cable S. The upper part of the swivel A is made with two eyes or ears, carrying the links C C, by which the swivel is attached to the heart-shaped piece D. At the apex of D is the shackle F, to which is attached the chain cable. In the middle of D is a vertical hole E, through which is carried the telegraph cable S. Passing through the hole the cable enters and is secured to the pipe G G, which can rotate within the vertical hole in the upper part of the crown-shaped swivel. This pipe G G terminates in a flange, which is bolted to the flange of the pipe L at H. The pipe L carrying the conductor is fitted into the spindle B and is secured and rendered watertight by the gland K. Thus, when turns are taken in the chain and telegraph cable, a force is set up which causes the heart and crown attachment to rotate. The telegraph cable is provided at every foot with chafing rings Y Y, see Fig. 5. These rings make the cable more rigid, the chain and telegraph cable being seized together at every other link. Fig. 5 shows the arrangement adopted in mooring a light-vessel by means of a bridle. Two of the anchors are placed the

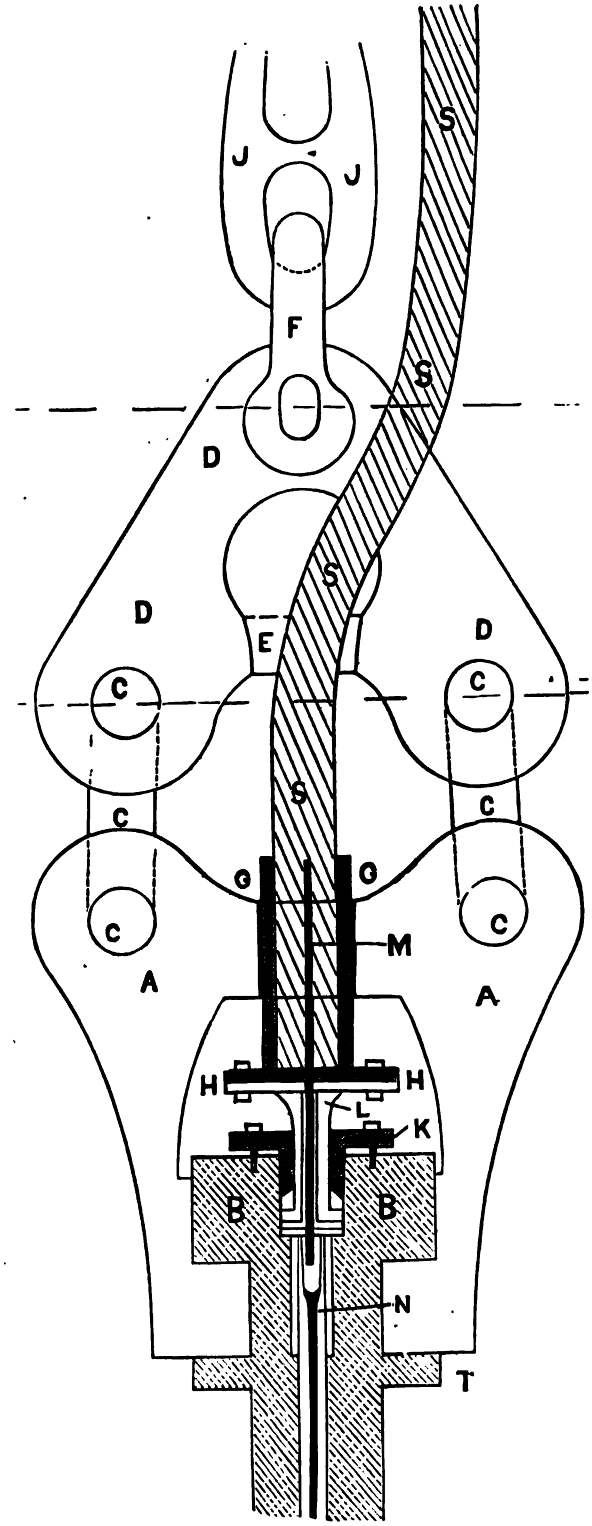


FIG.

necessary distance apart, and the cable is laid from the shore, dividing at a suitable point into two parts, each

of which goes to its respective anchor. The mooring chains, with the telegraph cables, are led to and connected with the T-piece P, at the extremity of which is the heart and crown swivel attachment, to which is attached the chain cable J, by which the light-vessel rides. The cable passes through a separate hawse pipe, and over a

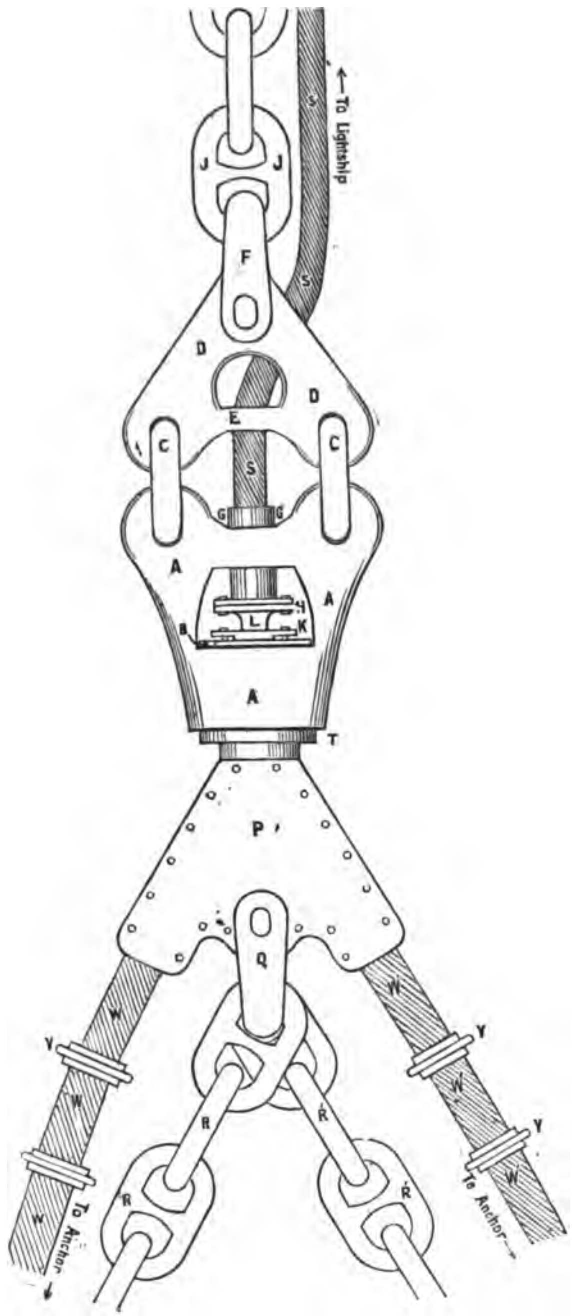


FIG. 5.

drum, and is finally coiled away in a cable tank, the end being connected with a wire to the testing, or instrument room, in the usual manner. From the foregoing description it will be seen that the inventors, whose address is care of Messrs. Curtis and Hilton, 7, Union Court, Old Broad Street, E.C., have placed before the public an efficient and reliable means of establishing and maintaining electrical communication between the shore and a light-ship, and one which is not liable to suffer interruption from either mechanical or corrosive action.

COMMUNICATION RELATING TO THE RESULTS OF A SERIES OF PROGRESSIVE TRIALS CARRIED OUT AT CHERBOURG ON A TORPEDO BOAT. *

BY MONS. L. DE BUSSY, HONORARY MEMBER.

THE object of this communication is not to place before the Institution any novel facts, but to add to its stock of information by putting it in possession of the results obtained, while subjecting a torpedo boat belonging to our national marine to a series of trials, carried out at progressively increasing speeds, in which the excellent method so frequently employed by the late Mr. W. Denny was followed, the advantages of which have been put in evidence by many interesting papers contributed by different members, and notably by that of W. H. White, Esq., Director of Naval Construction, "On the Speed Trials of Recent Warships." (Transactions, vol. xxvii. pages 1—12).

Being desirous of emphasizing the importance which the French constructors attach to this fertile method of experimenting, the author thought that it would be agreeable to this Institution if he obtained from the Minister of Marine the authorization to communicate the results of the trials in question, which were obtained at Cherbourg on a torpedo boat, 33 metres (108 ft.) in length, constructed by Mr. A. Normand, of Havre.

The formula which is made use of in France to determine the speed corresponding to a given power is

$$v = m \sqrt[3]{\frac{\text{I.H.P.}}{B^2}}$$

where

v is the speed in knots.

B^2 the area of the midship section in square metres.

m the co-efficient of efficiency, which had to be determined for the various speeds.

The experiments were all carried out on the same day, in identical circumstances of weather, sea, and draught of water. Each of the results is the mean of three runs on the measured distance. In order to eliminate the influence of the variation of the current, the figures obtained on the intermediate run were doubled. Thus were obtained the results given in the following table, which are given exactly as they were obtained, and without any correction.

Speed in Knots. v. (1)	Number of Revolutions per Minute. (2)	H.P.I. on the Pistons. I.H.P. (3)	Values of $m = v \sqrt[3]{\frac{1}{\text{I.H.P.}}}$ Taking the Square Metre as the Unit of Surface. (4)	Taking the Square Foot as the Unit of Surface. (5)	Observations.
4·7	64·15	9·33	2·863	6·322	The value of B^2 or the immersed area of midship section, is 2·11 square metres, or 22 square feet. The displacement is 46·10 tons.
8·91	126·16	42·44	3·276	7·233	
10·20	145·73	62·19	3·302	7·307	
10·94	157·99	67·33	3·449	7·615	
12·89	186·57	120·93	3·343	7·381	
14·58	215·37	184·23	3·286	7·256	
16·80	253·97	300·58	3·216	7·102	
18·20	275·68	377·40	3·230	7·132	
19·30	293·32	443·65	3·242	7·159	

An examination of this table reveals two interesting peculiarities:—

1. The value of m, which is very small at low speeds, increases up to 11 knots.

* *Read at the Twenty-eighth Session of the Institution of Naval Architects*

2. This value attains a minimum of 17 knots, and increases slightly for higher speeds.

The first peculiarity must no doubt be attributed to the fact that the efficiency of the engine, in mechanical work on the shaft, diminishes in proportion as the speed of revolution is decreased. It cannot be doubted that if the power actually transmitted to the screw, instead of that indicated on the pistons, could be introduced into the formula, the efficiency measured by the coefficient m would be greatest at the low speeds. This first peculiarity, then, appears to proceed from circumstances inherent in the motor. The second, on the contrary, evidences a diminution in the resistance of the hull when a certain speed is exceeded, and is, in consequence, particularly worthy of attention.

AN ITALIAN TORPEDO-BOAT.

A NOVEL torpedo-boat, built by Messrs. Yarrow & Co., Poplar, for the Italian Government, was lately tried on the measured mile at Lower Hope, below Gravesend, in the presence of Count Candiani d'Olivola, Italian Naval Attaché, and Captain Carnevali, and Messrs. Soper and Smale on behalf of the English Admiralty. The boat is the first of two boats ordered, and is 140 ft. on the water-line by 14 ft. beam, and is propelled by twin-screws and compound engines capable of indicating between 1,500 and 1,600 H.P. There are two locomotive boilers of the usual torpedo-boat type, placed one forward of the engine-room and the other abaft. The connections are so arranged that each engine has its own pumps, condenser, and boiler quite separate. There are, however, pipes which can be used so that in case of one boiler or engine being disabled the other will supply either or both engines with steam. As the stokeholds are separated from each other by the engine-room there is of course a fan provided to each. The boilers are fitted with the makers' patent watertight ashpan arrangement, which prevents the fires from being extinguished in case of sudden or serious leakage caused by the riddling of the boat by shot or other casualties. With these ashpans the craft can run a distance of 50 or 60 knots after the water has risen in the stokeholds above the fire-doors. The armament of the vessel consists of two torpedo tubes built into the bow; two torpedo tubes placed at a small angle with each other and fitted on a turntable on the after part of the deck, for firing over the sides; and a brace of quick-firing Nordenfeldt guns. There is good accommodation for officers and crew. There is also a galley compartment, while in the stern are separate cabins for petty officers, storerooms, &c. The boats are fitted with double steam-steering gear, giving independent control of either bow or stern rudder; and, apart from this, the twin-screw arrangement alone affords complete command of the boats should both the rudders happen to get disabled. A dynamo electrical machine, driven by a Brotherhood engine, is fitted in the galley compartment for producing the electric light, and also the air-compressing machinery for charging and expelling the Whitehead topedoes. The safety of the boats is provided for by 11 water-tight bulkheads, each compartment having a powerful steam ejector for discharging water, in addition to its hand-pumps. Besides these precautions, there is also a centrifugal pump in the engine-room, driven by an independent engine, which circulates water through the surface condensers, and is constructed to suck water out of any of the main compartments. The trial was very successful, as the following tabulated results of six runs, with and against the tide, will show, the guaranteed speed being considerably exceeded:—

Runs.	Engines.	Steam Pressure.	Vacuum.	Revolutions.	Speed.
1	S	135	26	355	22·641
	P	135	27	373	
2	S	125	26	366	27·272
	P	132	27	364	
3	S	125	26	358	22·360
	P	130	27	373	
4	S	127	26	361	27·692
	P	133	27	376	
5	S	128	26	364	22·360
	P	134	27	378	
6	S	132	27	359	27·692
	P	132	27	369	
Means......	—	130	26½	360½ 372	24·964

JUNIOR ENGINEERING SOCIETY.

ON March 25th a numerously attended meeting of this Society was held, when a paper was read by Mr. W. Chas. C. Smith on "Torpedo-Boats and Machinery." The leading characteristics of torpedo-boats—lightness, limited dimensions, high speed of machinery, and great manoeuvring power—were first enlarged upon, and their sizes and types classified. The necessity of the adoption of a standard type was receiving the attention of the maritime powers, but opinions as to the utility of torpedo-boats had been considerably altered since the experiments on the condemned ironclad *Resistance* had been carried out. The value of the torpedo as a destructive agent was stated at some length, and a description was given of some recent experiments with it, after which the author proceeded to point out the risks to which torpedo-boats are exposed and their means of defence, stating that the question of the necessary armament to resist machine-gun attacks had been considered, but owing to loss of speed occasioned by the additional weight had not been adopted. A detailed account of several boats and their engines then followed, including the *Lightning*, of Messrs. Thornycroft, and the torpedo-boat catcher *Falke*, of Messrs. Yarrow, their respective performances being given, comparisons being drawn with other types of marine-propelling machinery. The paper concluded with a reference to three types of submarine boats—the *Nordenfeldt*, the *Nautilus*, and the *Peacemaker*.

TWIN-SCREW TORPEDO VESSELS "WIBORG" AND "DESTRUCTOR."*

By J. H. BILES, Esq., Member.

I VENTURE to lay before this Institution a short description of two torpedo vessels which have each some features in them not common to vessels of this class.

The *Wiborg* was built at Clydebank for the Russian Government. The general particulars are given at the end of this paper. The conditions laid down to us were:—

(1) Speed to be 20 knots per hour upon two trials, each of three hours' duration.

(2) The weights on board at these trials to be a load of 15 tons, representing armament, torpedoes, stores, men, and equipment, and an additional 14 tons of coal, or 29 tons in all.

(3) Between the two full-speed trials a consumption trial of 12 hours' duration to be made, to show that with the trial weight as above on board the vessel could steam 1,200 knots at a speed of not less than 10 knots per hour.

(4) The armament to consist of two 5-barrelled Hotchkiss 47-mm. revolving cannon, with 500 rounds of ammunition to each gun.

(5) The torpedo tubes to be three in number, two through the bow and one on deck, each 19 ft. long.

(6) Metacentric height to be not less than 1·75 ft.

(7) The pumping power to be sufficient to eject at least 520 tons of water per hour, independently of the pumps for surface condensers.

(8) The bunker capacity to be sufficient to give vessel a radius of action of at least 2,000 knots at 10 knots.

The dimensions selected to fulfil these conditions were:—Length on water-line, 142 ft.; beam moulded, 17 ft.; depth at middle of deck, 9 ft. 6 in. In fixing these dimensions the following considerations were kept in view:—

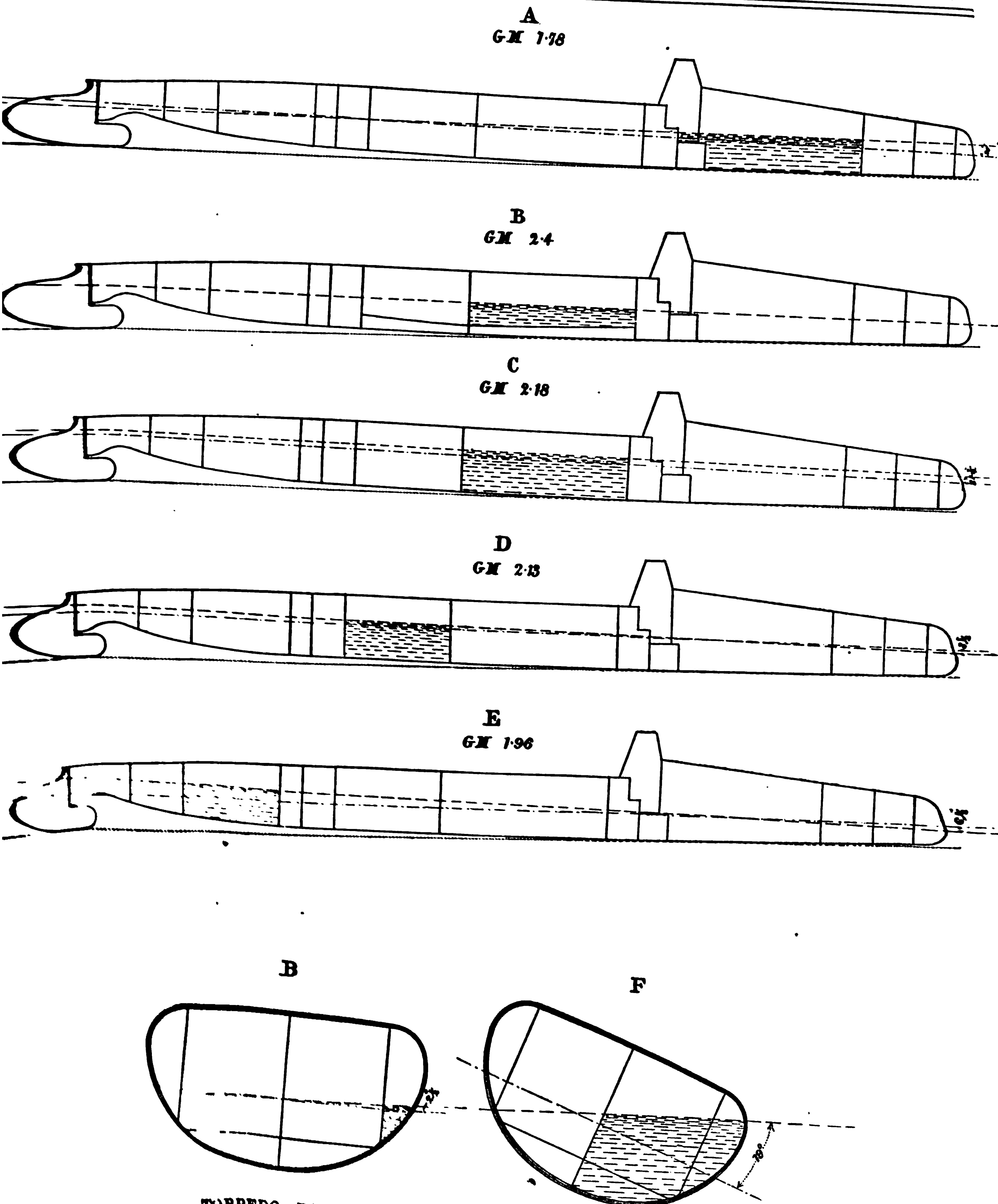
1st.—The torpedo boat fighting tactics of the Russian officers were said then to consist of a run straight to the enemy at full speed to within 700 yards, when the engines were suddenly to be reversed, and the bow torpedoes fired as soon as way was off the vessel. As rapid a retreat as possible was then to be made at full speed astern.

2nd.—The vessel was intended to act against a fleet of hostile torpedo boats, and must, therefore, be prepared to receive a much greater number of wounds from small guns than these boats could each receive.

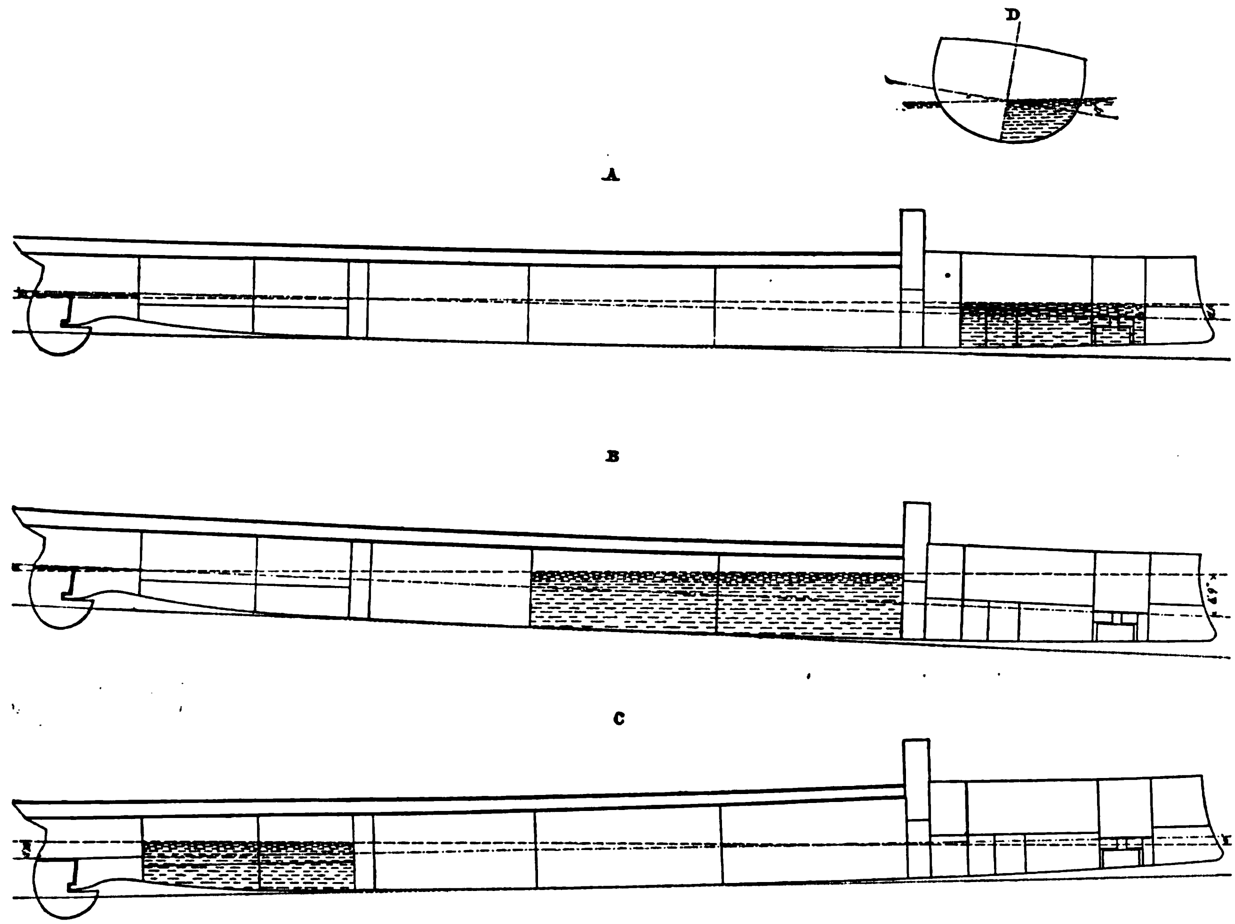
3rd.—As her radius of action was much greater than that of torpedo boats, her habitability ought to be increased, and made as nearly as possible equal to that of an ordinary cruiser with the same radius of action.

The first consideration made it desirable to protect the bow torpedo tubes from machine-gun fire as much as possible. This end was attained by giving the vessel the long sloping bow shown in the drawing, and by covering this bow with plating ½-inch thick,

* *Read at the twenty-eighth Session of the Institution of Naval Architects.*



TORPEDO BOAT "WIBORG."—Fig. 1. (For Description see page 49.)



TORPEDO BOAT "DESTRUCTOR."—Fig. 2. (For Description see page 52.)

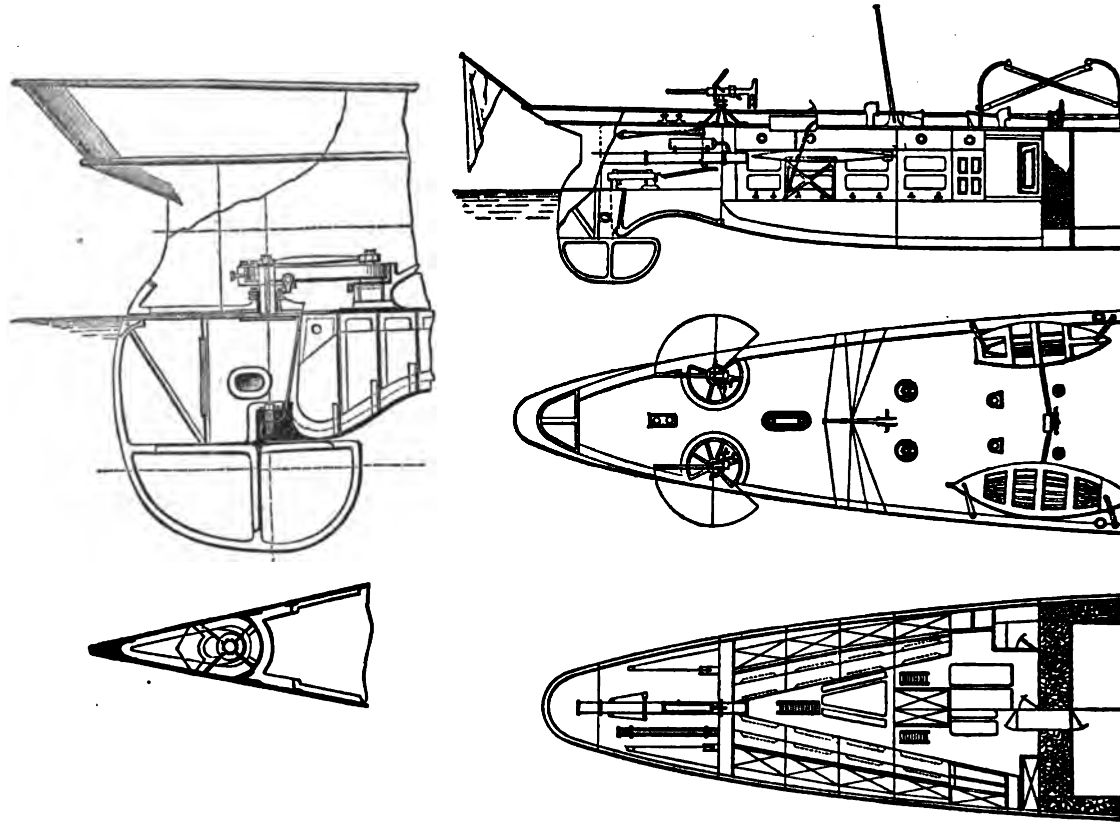
To ensure rapid reversal of engines steam starting gear was fitted, a course seldom adopted in such small engines. In order to ensure capability of steering when running considerable distances at full speed astern, the rudder and the after part was shaped as shown in the drawings.

The second consideration pointed to as minute a subdivision of hull, and as complete a duplication of vital powers, as was possible. Consequently, twin engines and twin boilers were adopted, though both were in this type of vessel a novelty. The boilers are in separate watertight compartments, but it was considered desirable in such a small vessel, with her limited crew, not to add to the difficulties of looking after the machinery by placing a bulkhead between the engines. The vessel is divided into twenty-three compartments. The alterations of trim due to flooding some of the largest compartments is shown on Fig. 1. To still further enable the vessel to maintain her fighting capabilities with as many wounds as possible in her, the side in the vicinity of the water-line in the crew compartment forward, which is the largest in the ship and which is most likely to be penetrated when attacking an enemy, has a double watertight skin. This double skin is subdivided into cells by small transverse bulkheads in which cells can be fitted with water-excluding substance, so that in the vicinity of the water-line the largest compartment of the vessel has what is practically a cofferdam round her side. The engines and boilers have protection afforded them by the coal bunkers, which completely surround them. The magazine is placed well below the water-line. The pumping power in the vessel is an element in the quality of her capability to receive without fatal results a large number of wounds. She has ten ejectors, capable of discharging 1,500 tons of water in all per hour; and her two centrifugals are capable, in addition, of discharging about 300 tons per hour. In order to make use of this pumping power the boilers would have to be fed from the sea, but their capability of raising steam is far more than equal to the demand which would be made by these ejectors.

The third condition, as to habitability, can only be decided by reference to the vessel's behaviour at sea. But it is certain that it is necessary to give a sufficient amount of deck space and cubic capacity per man in the living quarters. The total complement of the boat is 22, four of whom are officers, and are accommodated in the after-part. The clear deck area per man for the 18 men is 9 square ft., and the space per man is 120 cubic ft. The living compartments are placed in communication with the forced draught fans, so that as long as the stokehole ventilators can be kept open, these compartments can be well ventilated. But these are, I venture to think, nearly all that a ship designer can do in a vessel of this type. The condition of lightness of hull and machinery which must be fulfilled in order to obtain the high speed desired, taken in conjunction with the conditions as to subdivision and habitability already mentioned, make the percentage of surplus buoyancy very high, and consequently a vessel of this character is very lively in her motions. This liveliness is not compatible with comfort, and consequently tends to detract from the habitability of the vessel. The results of the consumption trial showed, that with the 45 tons of coal which the bunkers would hold, the vessel had a radius of action of over 4,000 knots. The results of her behaviour at sea, as reported by her commander, showed that she could safely go through heavy weather, but whether her crew could remain in working condition long enough to traverse 4,000 knots at 10 knots, which would be about 17 days, can only be determined by continued trial.

On her speed trials, details of which are given at the end of this paper, she attained 19·96 knots with nearly 41 tons weight on board, and she attained 20·6 knots with nearly 34 tons weight. These speeds are the mean of the speed on the three hours' runs as deduced from the revolutions. At a later trial, with bunkers full and all stores and equipment on board ready for sea, she attained a mean speed of 18·55 knots. The total weight on this trial was about 70 tons.

The system of rudder adopted, with its partial balance, lends



SPANISH TWIN-SCREW SEA-KEEPI

itself very readily to the use of rudders of large area. In addition to the advantage in rapidity of turning, which increased area gives, there is a further advantage in twin-screw ships, that a very small angle of helm is necessary in order to keep the vessel on her course with one screw only running. One degree of helm in this vessel was sufficient, and with one engine going full speed, the other screw dragging through the water, the vessel attained a speed of 17 knots per hour. With two engines and one boiler she attained 17½ knots. A further advantage in the system of rudder is the control it gives when going astern. The strain on the steering gear is somewhat greater, but the control is quite as complete as when going ahead. At full speed astern the speed attained on the measured mile was 16 knots per hour. The circle turned going astern was smaller than when going ahead, but the time was longer.

Both these vessels were lighted throughout with incandescent electric light, and had a search light of 12,000 candles.

The *Destructor* was built for the Spanish Government, and is a vessel 192 ft. long on water line, 25 ft. beam, and 12 ft. moulded depth. Her displacement fully equipped for sea, but with coal sufficient to steam 2,050 knots is nearly 400 tons. The other leading particulars are given at the end of the paper.

The conditions to be fulfilled in this vessel were similar in character to the *Wiborg*.

(1) The speed to be 22½ knots per hour upon two trials, each of which to be of three hours' duration.

(2) The load at the trial to be 43 tons of stores, outfit, and equipment, 37 tons of coal, and 8 tons of fresh water for boiler service; a load of 88 tons in all.

(3) Consumption trial of 12 hours, to show that 37 tons will drive vessel at least 1,500 knots.

(4) The armament to consist of one 9 cm. gun; four 6-pounder rapid firing, two 47 mm. revolver Hotchkiss; five torpedo tubes, two in the bow, one in the stern, and one in each broadside, each 15 ft. long.

(5) Metacentric height not less than 3 ft.

(6) Pumping power to be 2,000 tons per hour.

(7) Bunker capacity to be sufficient for radius of action of 3,500 knots.

The considerations which led to the fixing of the dimensions of this vessel were very similar to those of the *Wiborg*, and the measures taken to give effect to these considerations were very similar. But as the chief object in making this vessel larger was to increase her habitability at sea, it was thought desirable to make her more like a small cruiser than a large torpedo boat.

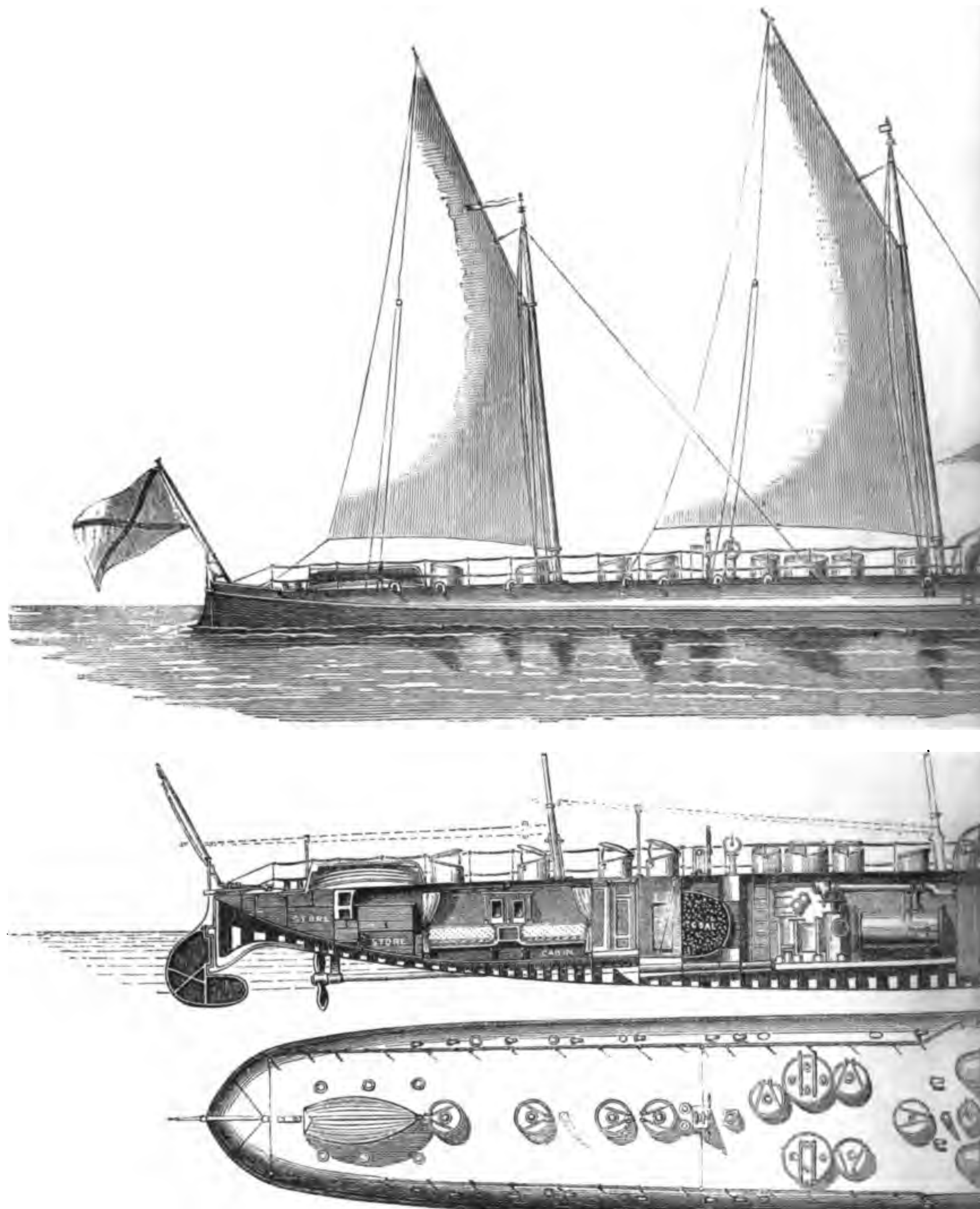
Bulwarks and a wooden deck were fitted to her. The officers have five cabins and a ward-room. The engineers, stokers, and crew have separate quarters for each class.

The scantlings of this vessel are sufficient to give her a strength of 5·2 tons per square inch, assuming her to be balanced instantaneously on a wave of her own length and 11 ft. high. In still water her strains are practically nil.

The material of which she is made has a tensile strength of from 32 to 36 tons per square inch.

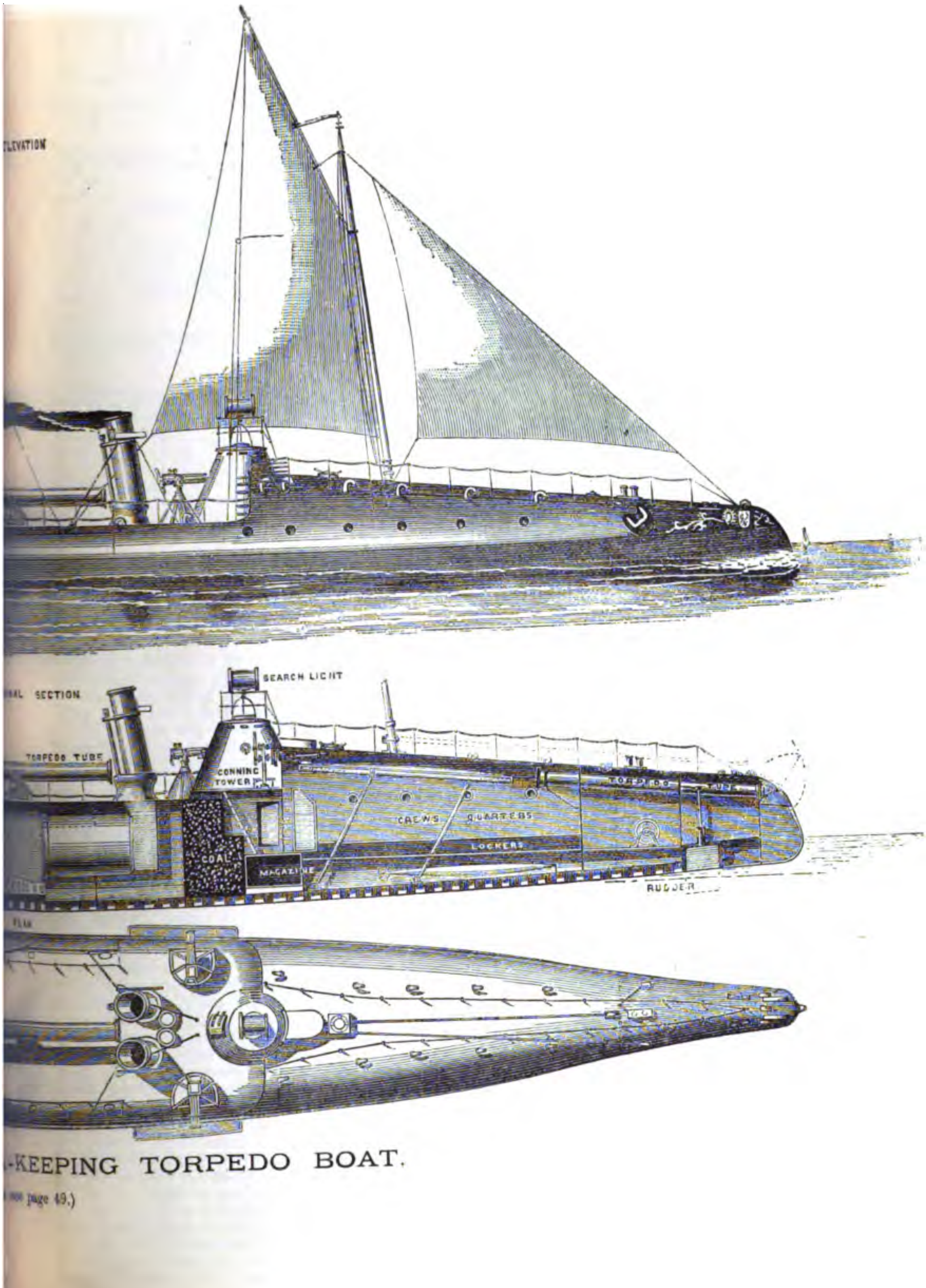
The vessel is divided into thirty-nine water-tight compartments. The engines in this case are in two separate engine-rooms, and the boilers are in four separate compartments. Coal protection is afforded round the machinery and the boilers by the bunkers; but in addition, abreast of the engines, the bunker bulkheads are formed of steel plates ¾ in. thick, which are placed there to protect the machinery from machine-gun fire. Forward of the boilers and magazines is placed a curved bulkhead 1¼ in. thick to give protection from raking fire. The general arrangement of the vessel may be seen from the plans.

This vessel at her trials on the Clyde attained a mean speed of 22·56 knots for three consecutive hours. The mean I.H.P. developed was 3,784 and the mean revolutions of the two engines 292·0. On a subsequent three hours' trial the mean speed was 22·68, the I.H.P. and revolutions corresponding being 3,829 and 292·3. At the consumption trial the vessel was run at a mean speed of 11·6 knots for eleven hours on a total consumption of 57 cwt. This was obtained by using only two boilers, and the result corresponds to a radius of action of 4,929 knots at 11·6 knots. The mean I.H.P. over the eleven hours was 297, so that the



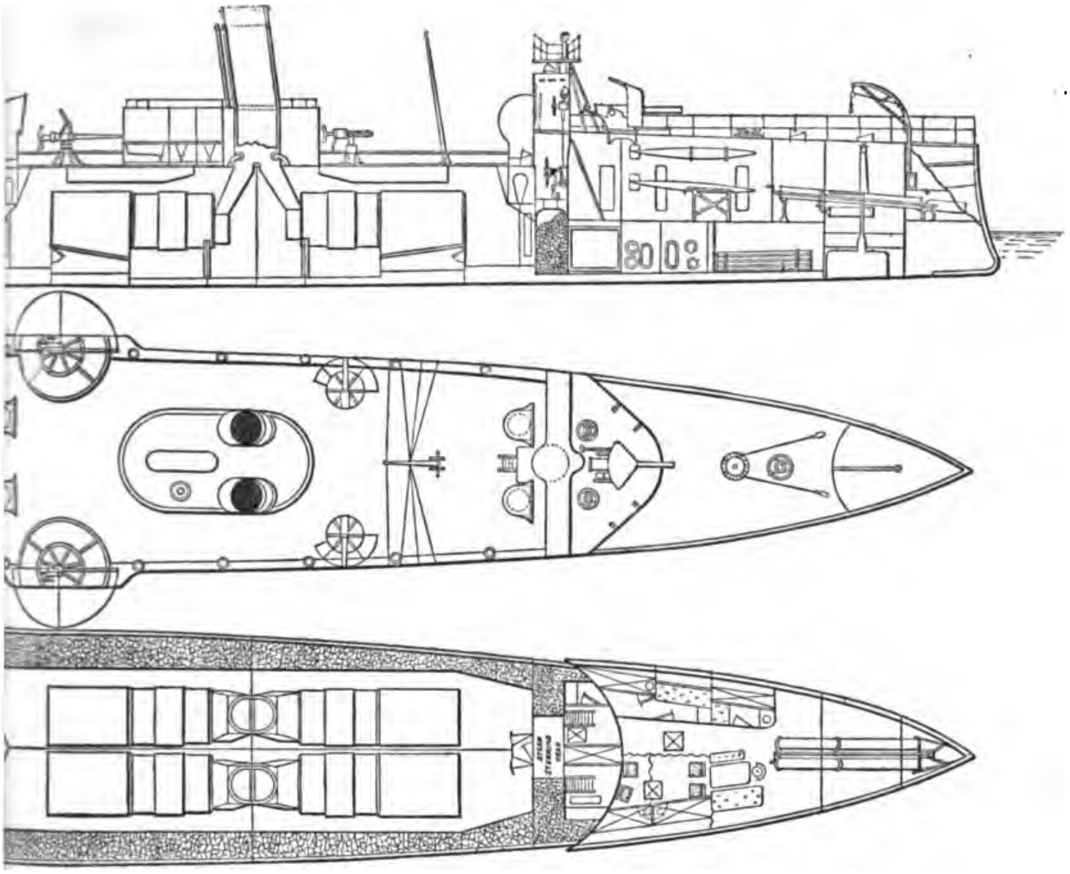
RUSSIAN TWIN-SCREW

(For Des



-KEEPING TORPEDO BOAT.

see page 49.)



OAT. (For Description see page 52.)

consumpt corresponds to 1·95 lbs per I.H.P. per hour. The consumpt of coals at the full speed trials, which were made with a mean air pressure of 2¼ in., was 2·4 lbs. per I.H.P. per hour. There is no doubt that a much lower rate of consumption per I.H.P. per hour was obtained between these two speeds, but no means were taken to measure it.

The consumption at full speed is not as high as might have been anticipated, and it gives the vessel an estimated steaming power of 540 miles at 20 knots. As a matter of fact she ran on January 24 and 25 from Falmouth to Muros (just beyond Finisterre), in twenty-four hours, a distance of 495 knots, which is at a mean speed of 20·625 knots. As the result of an application to the Meteorological Office for a report of the weather during this run the following has been received :—

"Wind was at daybreak at Falmouth S.S.E. moderate (force 4 by Beaufort Scale); subsequently freshened from about same point.

"Strong to fresh S.E. and S.S.E. breezes (force about 6) felt all across the Bay of Biscay. Sea most probably rather rough, but as the wind was blowing off the land the value given from our own stations hardly represent the condition out at sea."

Captain Villaamil, the commander of the ship, reports that "the sea was rough, and vessel rolled and pitched considerably in consequence, but one could not wish to be in a better little sea-boat." I hope the members of this Institution will forgive my taking up their time with these details, but as no run of such great length, at such a speed, has to my knowledge been made before, I have thought it desirable to give the information in connection with it as completely as I am able. The vessel left Falmouth with her bunkers full, but I have no exact information as to the amount of coal burnt on the run above described.

As to the sea-going qualities of the *Wiborg*, she is reported to have behaved very well in her passage from the Clyde. On a part of her journey she went through a gale of wind, and I have received the following report from the Meteorological Office as to the weather at the time and place :—"Ship left Holyhead on morning November 5th, 1886. Wind very light and variable, sea smooth. Afternoon, wind drew into N.W., light to moderate till night, and sea slight. During the night of the 5th and early morning of 6th wind rose to a fresh gale (force 8), from W.N.W.; sea very rough; wind and sea both decreased a little after passing Land's End."

She steamed at 10 knots, so that the above is only a guide for cruising purposes. The metacentric height of the *Wiborg* varies from 2·5 light to 2·3 load, and the *Destructor* from 4·9 light to 4·3 load.

As may be seen by reference to the particulars at the end of the paper, the *Wiborg* has compound engines working at 130 lbs. boiler pressure. The *Destructor* has triple-expansion engines, working at 145 lbs. From an estimate of the weight of steam used per I.H.P. per hour in these two cases, taken from a considerable number of diagrams, it appears that in the compound the consumption is 19·0 lbs., and in the triple it is 15·33 lbs., or a saving of 19·3 per cent. in favour of the latter, neglecting any advantage due to the small difference of pressure.

The rudders of these two vessels are a departure from ordinary practice. That of the *Wiborg* is flat, and of about 40 square ft. in area. In the *Destructor* an extension of this system is adopted, and it is combined with an under-water rudder head. The rudder is formed as a continuation of the after-body lines down as far as the bottom pintle. The dead-wood is arched up to allow the forward compensating part to work freely. By making the rudder of the form shown, the length of the ship is virtually increased while the resistance to turning remains the same. By an extension of this system it is possible to obtain the advantage of the long ship with its consequent extra speed, and the rapidity of turning of the short ship, both of which advantages are of the first importance to a warship.

Figs. 1 and 2 show the *Wiborg* and *Destructor* with some of the principal compartments flooded.

I have collected these facts in order to place on record in this Institution a description of two small vessels, which are each in some respects unlike anything of the kind which had been done before.

The following are the leading particulars of these two vessels:—

	Wiborg.	*Destructor.*
Length between perpendiculars	142 ft. 6 in.	192 ft. 6 in.
Breadth	17 ft.	25 ft.
Depth at centre	9 ft. 6 in.	13 ft.
Normal displacement	133	385
Load displacement	167	458
Draught due to normal displacement	4 ft. 7 in.	6 ft. 3 in.
Draught due to load displacement	5 ft. 2 in.	7 ft.
I.H.P.	1,400	3,800
Revolutions	380	292
Diameter of cylinder	14 in. by 24½ in.	18½ in. by 27 in. by 42 in.
Stroke of cylinder	15 in.	21 in.
Number of boilers	2	4
Pressure	130	145
Grate surface	56	144
Number of torpedo tubes	{ 2 in bow 1 on deck	{ 2 in bow 1 in stern 2 on deck
Number of torpedoes	6, 19 ft.	6, 15 ft.
Number of guns carried (Hotchkiss Revolvers)	2, 37 mm.	7 { 1 4 in. 4, 6-pounders 2, 47 mm.
Number of officers and crew	22	45
Normal coal	14	37
Radius of action due to ditto, at 10 knots	1,400	2,050
Total bunker capacity	45	110
Radius of action due to ditto	4,000	5,500

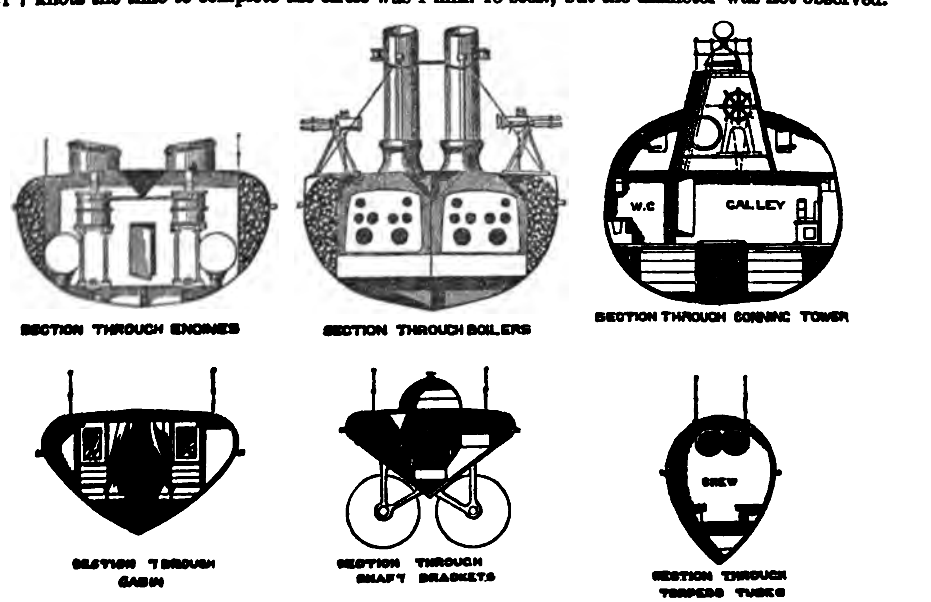
	1st trial.	2nd trial.	Deep trial.	1st trial.	2nd trial.
Load carried on speed trial	41	34	70	88	88
Displacement at trial	138	131	167	385	385
Mean speed for three hours	19·96	20·6	18·55	22·56	22·68
Revolutions, mean speed for three hours	381	380·1	362	292	292·3
I.H.P.	1,303	1,405	130	3,784	3,829
Load carried on deep load trial	70	161			
Displacement at deep load trial	167	458			
Speed	18·55	20·2			

	Wiborg.
Speed astern	16 knots
Revolutions at full speed astern	332
Time from signalling full speed astern till vessel was at rest	0' 30"
Time from ditto till vessel was at position at which signal was made	1' 11½"
Distance traversed	146 yards each way.

Time required to put helm over hard	8½ secs.	11 secs.	8½ secs.	12 secs.	8 secs.	8 secs.
Time to complete circle	1' 37"	1' 34"	1' 28"	1' 28"	2' 47"	1' 59"
Diameter of circle	160	175	220	230	150	150
Speed before going on circle	15	14·3	16·4	16·6	8·0	11·6
Speed on circle	10·7	11·2	14·2	14·6	5·03	7·0
Ahead or astern	Ahead.	Ahead.	Ahead.	Ahead.	Astern.	Astern.

The diameters recorded when going astern seem to indicate that the diameter is not reduced by a diminution in the speed to anything like the same extent as when going ahead.

At a speed of 21·7 knots the time to complete the circle was 1 min. 13 secs., but the diameter was not observed.



TORPEDO BOAT "WIBORG."

H.M.S. "ANSON."

THE last of the much-debated ships of the "Admiral" class, the *Anson*, which was taken round six weeks ago from Pembroke (where she was built) to Portsmouth to receive her armament and torpedo fittings and prepare generally for sea, completed her official engine trials in the Solent on April 6th. She is fitted with twin-screw vertical compound engines of 9,500 I.H.P. by Messrs. Humphrys, Tennant & Co. In design they are similar to the engines supplied by the same firm to the *Howe*, *Rodney*, and *Collingwood*, belonging to the same class of battle-ships. Each set of engines has one high-pressure cylinder, 52 in. in diameter, placed between two low-pressure cylinders, 74 in. in diameter, the stroke being 3 ft. 9 in. The surface condensers contain an ample amount of cooling surface. The air pumps are worked direct off the low-pressure cylinders, and are made entirely of gun-metal. The slide valves are actuated by link motion on Messrs. Humphrys' usual plan, with solid sectors motion conveyed to the high-pressure valve by means of a rocking lever. The crank-shafts are of hollow steel, made in three interchangeable lengths, while the frames for carrying them are made of cast steel, bolted on to box girders, which are built into and form part of the structure of the hull. This is an excellent arrangement, and saves a great deal of weight. The whole of the propeller shafting is made of Whitworth's hollow fluid-compressed steel. Gun-metal centrifugal pumps with separate engines are provided for circulating the water through the condensers, and an additional condenser of the same material has been fitted for condensing the steam used by the whole of the auxiliary engines throughout the ship. This condenser is provided with a separate circulating engine and centrifugal pump so as to be quite independent of the main propelling machinery. For the first time in a ship of war steam is generated in the *Anson* in eight four-furnace boilers, made entirely of Siemens-Martin steel. They are fitted with 3,408 tubes, 2¼ in. in diameter and 7 ft. long, and possess a collective area of firegrate of 756 square feet. The boilers are placed in four separate stokeholds, and are furnished with independent donkey pumps, &c., so as to render them entirely under the control of the stokehold staff. The forced draught fans are fixed in convenient and accessible positions, and are driven by Brotherhood's small three-cylinder engines. The propellers have a diameter of 17 ft. 6 in. and a pitch of 19 ft. 6 in. The weight allowed by Admiralty contract for boilers, engines, and fittings amounted to 1,225 tons, but, as a matter of fact, the weight actually on board does not amount to more than 1,150 tons, so that there has been a saving of 75 tons. This important difference will serve to diminish the immersion of the vessel when commissioned.

The full-power trial with natural draught was made on April 4th in very favourable circumstances as regards weather. As an illustration of the ease with which the leading marine engineers of the country can undertake the movement of these stupendous masses of inert matter—the *Anson* is of 10,000 tons displacement—and the confidence with which they can foresee results, though dependent upon the harmonious working of a prodigious number of reciprocations, it may be mentioned that the contractors in this case dispensed with the usual formal preliminary trial for the testing of bearings, but began the trial right away, after a short canter to sea for the purpose of getting up steam. The confidence was, moreover, amply justified by events, since no mishap of any kind occurred throughout the day, and the power developed was obtained without difficulty. It is only in the engining of small craft or ships of comparatively small displacement that repeated breakdowns of machinery have to be recorded, and the reason for this is not far to seek. The ship was in the command of Captain Tracey, while the machinery was in personal charge of Mr. Robert H. Humphrys, of the contracting firm. Her trim on the occasion was 22 ft. 6 in. forward and 24 ft. 2 in. aft, giving a mean draught of 23 ft. 4 in., or 3 ft. 5 in. less than her designed load-line. The natural-draught trials of our first-class battle-ships have now lost much of their interest, for although the Admiralty insist upon a certain minimum of power being developed during the run—in this particular instance amounting to 7,500 horses—yet, as the contract test is invariably reached with ease, the trial becomes mere child's-play in skilful hands. At the end of the trial the following mean results were recorded:—Steam in boilers, 94 lbs.; vacuum, 28 in. and 29 in.; revolutions, 97; and I.H.P., 8,320. Though greatly in excess of the specification, the power developed might readily have been increased had there been any necessity for it. One observation, taken when the engines were working at their best, showed that 9,000 horses had been developed, so that had the two first half-hours been thrown out, and the trial prolonged, the augmentation in the mean power indicated would have been considerable. But this was not deemed necessary, or even desirable, and the trial was brought to an end at the stated time. The speed of the ship, as tested upon the measured mile, was 16½ knots, the consumption of fuel during the entire run being equal to 2·3 lbs. per horse per hour. On the termination of the trial the turning powers of the ship were tested with both engines going ahead. The port half-circle was turned in 2 min. 28 sec., and the complete circle in 5 min. 15 sec.; while the starboard half-circle was turned in 2 min. 46 sec., and the complete circle in 5 min. 47 sec., the diameters being 640 and 650 yards respectively. The time required to get the helm hard over, 34½ deg. to starboard and 34½ deg. to port, was 27 sec.

The important and crucial trial under forced draught came off on April 6th, with results which may be described as unique. As on the previous trial, the ship and machinery were in charge of Captain Tracey and Mr. Robert Humphrys, while Mr. R. Sennett, Engineer-in-Chief of the Navy, attended on the part of the Admiralty; Mr. Alton, Chief Inspector of Machinery, on behalf of the Steam Reserve; and Mr. Corner on that of the Steam Department of the Dockyard. Staff-Engineer Purvis also watched the trial in the interests of the engineering staff of the ship. The day was exceedingly rough. The wind blew from the north-east with the force of from 8 to 9—a moderate gale—the sea being lumpy and flecked in all directions with "white horses." The course in consequence was confined between the Warner Lightship and Cowes, cascades of spray breaking over the weather bow as the armourclad swept down channel without perceptible lifting under the pressure of the water. Just as the first half-hour had been completed, and a collective power of 12,466·77 horses had been indicated, with 108 revolutions of the engines, a little dirt was forced into the low-pressure eccentric of the port engine, which caused it to heat. The engines were at once eased and a spare rod was substituted, and such was the accuracy of the workmanship that the engines were again started and driven at full speed and the trial completed without a hitch occurring, the following being the results of the half-hourly observations:—

Revolutions.		Mean Pressures.				Collective Power
S.	P.	H. Starboard L.		H. Port L.		
108·3	107·9	58·2	16·0	58·2	14·5	12,533·38
108·6	108·9	61·0	16·6	59·0	14·4	12,890·37
109·0	109·0	57·4	16·0	57·6	15·0	12,655·88
108·4	109·0	55·5	15·1	57·6	14·35	12,198·59
109·2	109·5	57·8	16·4	59·5	14·75	12,853·22
107·9	109·0	59·0	15·7	58·5	14·7	12,594·53
108·6	109·6	57·4	15·4	57·4	14·65	12,458·77
108·9	108·3	55·0	15·3	58·0	14·95	12,357·51

The new type of boilers worked very satisfactorily. They save weight and stokehold space, and are constructed to blow off at a pressure of 100 lbs. to the square inch. Although the air-pressure never exceeded 2 in., the steam was blowing off through the safety-valves during the whole trial, so much so that near the end the pressure was slightly reduced. The means recorded were:—Steam in boilers, 101 lbs. Vacuum—starboard, 28 in.; port, 28 in. Revolutions—starboard, 108·6; port, 108·9. Mean pressures—starboard, high, 57·66; low, 15·81; port, high, 58·22; low, 14·66. I.H.P.—starboard, high, 3,023·6; low, 3,359·8; port, high, 3,060·9; low, 3,123·3. Collective I.H.P., 12,567·78. Consumption per hour per horse, 2·2 lbs. The power developed was thus not only greater than by any ship of the "Admiral" class, but is considerably greater than at the trial of any ship in the service, being not less than 3,068 horses beyond the contract, and at an expenditure of fuel not greater than with natural draught. In the course of the four hours' trial five runs were made on the measured mile, the result giving a mean speed of 17·435 knots an hour.

As the *Anson* is the last of the class we append the performances of the whole of the "Admirals":—

Ship.	Natural Draught.	Forced Draught.
Collingwood:—		
Indicated Horse Power	8,099·84	9,573·0
Speed	16·603	16·844
Howe:—		
Indicated Horse Power	7,733·42	11,728·8
Speed	15·872	16·936
Rodney:—		
Indicated Horse Power	8,259	11,156
Speed	16	16·9
Benbow:—		
Indicated Horse Power	8,658	10,860
Speed	16·5	17·5
Camperdown:—		
Indicated Horse Power	8,605·96	11,740·88
Speed	16·305	17·144
Anson:—		
Indicated Horse Power	8,319·12	12,567·78
Speed	16·523	17·435

It is to be noted that while the other ships on the list use steam at 90 lbs. pressure, the *Anson* takes it at 100 lbs. pressure. But in her case the number of boilers is reduced from twelve to eight. It is necessary, in order to explain the apparent anomalies in the tabular statement of results as regards differences of speed, to point out that the important factor of draught requires to be taken into consideration. The *Howe*, for instance, with greater I.H.P. than the *Benbow*, is represented as realizing nearly a knot less speed. The discrepancy was due to the fact that the *Howe* was tried on the measured mile at her load-line, whereas the *Benbow* was tried in a light condition and her speed was measured by patent log.

AMERICAN SHIPPING.

THE astonishing fact that all steamer lines which unite America with the old world belong to European companies causes increased dissatisfaction to our transatlantic cousins, since they boast to have proved by last year's regattas their ability of surpassing even England in the construction of sailing vessels. It is therefore only natural that plans are ripening on the other side of the great water to beat Europe in oceanic steamboat building, and particularly in respect of speed. As similar threats have been made over and over again, and all turned out to be idle talk, not much importance is attached to the new project, yet the Americans seem to treat the matter in full earnest. Mr. Fryer, a well-known shipbuilder in the United States, is reported to be constructing a steamer, called *Pocohontas*, which is expected to be launched in November. To judge by the illustrations given of this vessel it has so many peculiarities and improvements compared with European steamers that its appearance on the ocean, should it take place at all, would be likely to bring about a complete revolution in steam navigation. It will therefore be interesting to describe the principal features of the *Pocohontas*. Her immense length in comparison with her width is the first striking point. Whereas sailing vessels do not exceed the proportion of 1 to 5, and steamers, at the utmost, 1 to 10, the American novelty is 13½ times as long as wide. By 540 ft. length, the steamer has a width of only 40 ft., and resembles a floating ruler. This insignificant width necessitates exceptional precautions against the danger of capsizing, and the vessel is consequently supplied with a keel of 510 ft. length, weighing as much as 750 tons. A long and narrow body like the *Pocohontas*, if destined to resist the waves of the Atlantic, must be much fortified, and she has consequently many heavy supports in all directions. It is stated that the vessel is thus sufficiently strengthened to serve as a railway bridge, and that the heaviest trains passing over the deck would make no impression whatever on her steadiness. A further peculiarity refers to the boilers, which are placed behind each other along the board wall; the six chimneys are consequently not in the centre, but three on each side are coming through the deck, also close to the board walls. The engine is however in the middle, and moves the screw with a force which can be raised to 28,100 H.P. The utmost H.P. hitherto employed is 13,000. A secondary engine works a double screw, placed in the forepart of the steamer; its object is to turn the bow rapidly in case of danger, and to assist in the execution of manœuvres and in slowly entering a port when the helm should fail to act.

There are also arrangements by which the whole hull of the ship is divided into 1,060 waterproof apartments, and by which cabins, saloons, engine rooms, tunnels, &c., are filled in case of need with compressed air to an extent which it is supposed will form an efficient wall against water, and stop its progress. It is, however, extremely doubtful if that system will work satisfactorily. It may be possible with regard to the waterproof divisions, but it is not likely to keep saloons, cabins, &c., sufficiently well closed to prevent fixed air from escaping. The sudden and greatly increased air pressure would moreover seriously endanger the passengers' lives, unless they managed to get out of those rooms in time. Amongst other institutions made for increased safety may be mentioned a long tunnel in the forepart of the vessel which contains a number of boats. At the approach of danger the passengers are to take their seats in them before they are let into the water by means of the opening of the tunnel. The advantage of this novelty is rather problematic.

The cabin beds, like in sleeping carriages, are turned back during the day, thus increasing the comfort of the cabins, whereas the principal saloon—in true American fashion—may be transformed at will into a theatre or a church, with organ and all usual appliances.

The *Pocohontas* will have five masts, and an adequate number of sails in support of the engine. She will carry no freight, but passengers only, and promises to accomplish the sea-passage within six days, a saving of a whole day. "*Qui virra, verra.*"

Miscellaneous.

THE Sunderland Shipbuilding Company have received orders to construct three steamers—two iron and one steel. These will give employment to a large number of men for some months.

THE Secretary of the United States Navy has invited proposals from American shipbuilders for the building of three cruisers and two gunboats, the aggregate cost to be 5,400,000 dols.

THE BARTHOLDI STATUE AT NEW YORK.—The American Lighthouse Board has resolved to increase the illuminating power of the light borne by M. Bartholdi's Statue of Liberty, in order to render it one of the most powerful fixed lights in the world.

SUMMER MEETING OF THE INSTITUTION OF NAVAL ARCHITECTS.—The Council of the Institution of Naval Architects announce that they have received a most kind invitation from Mr. W. T. Doxford, the President of the North-East Coast Institution of Engineers and Shipbuilders, and from the Mayor and Corporation of Newcastle-on-Tyne, to hold a summer meeting this year at Newcastle-on-Tyne and Sunderland. The invitation has been accepted, and the meetings will take place at the end of July.

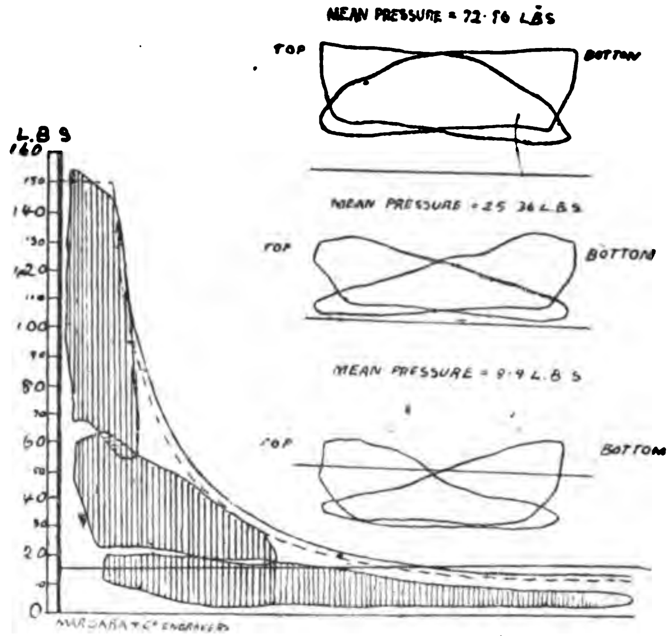
AN IMPROVED YACHT'S ANCHOR.—Mr. Wasteneys Smith, of Newcastle-on-Tyne, is at present bringing before the notice of the yachting world a modification of his well-known stockless anchor which should enhance its already acknowledged efficiency. This consists in constructing his anchor in only two pieces—the arms and crosshead being in one and the shank pivoted through same—the whole forming a very compact and serviceable anchor, with an entire immunity from fouling. Smith's patent anchors have now been adopted in every class of pleasure-boat, from the tiny canoe to Mr. Vanderbilt's *Alva*—the largest yacht afloat—and may therefore be justly considered the yachtsman's anchor *par excellence*. Several steam yachts have recently been fitted to stow these anchors up the hawse pipes, a simple method which dispenses with all "catting and fishing." Notwithstanding the continued depression in the shipping world, Mr. Wasteneys Smith has at present more orders in hand for his patent stockless anchor than on any previous occasion. Mr. W. Smith has just secured the anchor contracts for six new steamers of large dimensions to be fitted in this manner.

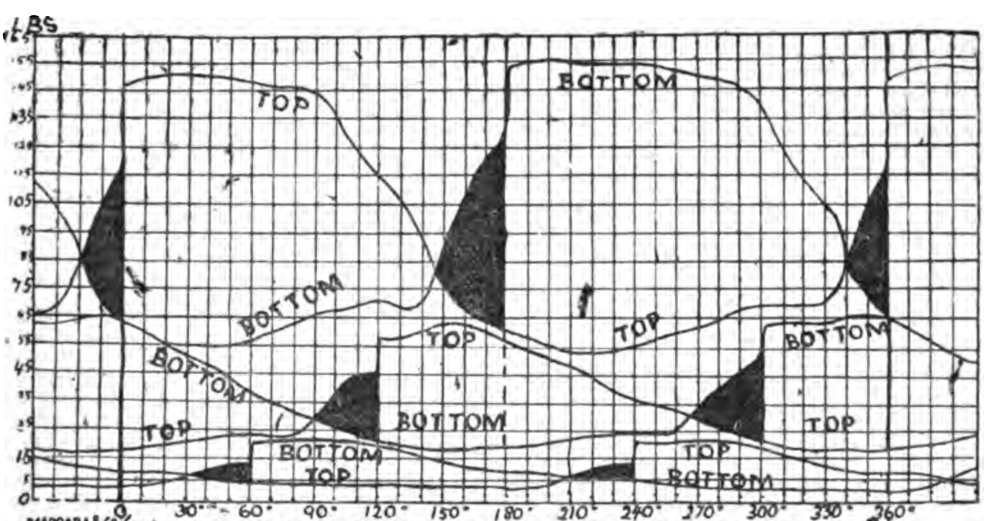
ON TRIPLE-EXPANSION MARINE ENGINES.*

ADJOURNED DISCUSSION.

(*Continued from page 6.*)

Mr. MUDD said there were many points that he should have liked to have spoken upon, but he should not be able to do so in consequence of what the President had said as to necessary limitation of time. At the last meeting he had shown a combined diagram of the indicator diagrams of the s.s. *Abeona*; would seem to be implied by the paper. All three valves in the engine of the *Abeona* were piston valves, and there was apparently not much loss due to contracted passages. Referring to the diagram, it seemed to have struck some that it could not be accurate, because the diagrams overlapped each other, and that it therefore appeared that the steam during admission in the second cylinder, for instance, was higher than the back pressure in the cylinder before it, which seemed to be an impossibility. It must be remembered the diagrams were not combined in their relative sequence in working. To show that that did not at all follow, he had made another diagram below it, which was what they called a continuous diagram, in which they would find that the lines did not at any point overlap each other, though in one place they met. He held an opinion which seemed to be at variance with that held



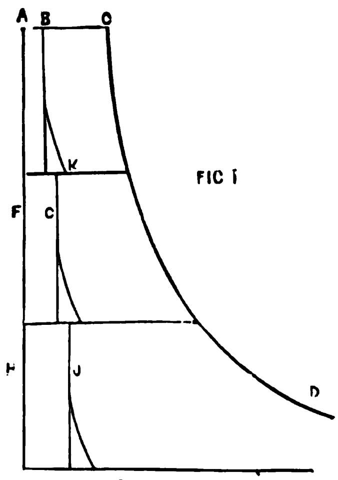


that diagram had been replaced by another, because the one shown at Leeds was not constructed on the same plan as the combined diagrams in the paper. His principal object was to prove what he believed to be the fact, that high-pressure crank leading gave better results than low-pressure crank leading on account of there being less space lost between the diagrams. He thought the diagram also proved one other point, that piston valves do not necessarily cause contracted steam passages as by the writer of the paper and by Professor Kennedy with regard to the proper method of showing indicator diagrams on a theoretical diagram, and he did not reconstruct the diagrams of the *Abeona* on the plan adopted in the paper, because he considered that the right method, but simply to permit of accurate comparison between engines with high-pressure crank leading and low-pressure crank leading. There were two points on which he differed from what Professor Kennedy said, and at the risk of correction he would venture to explain his views They would

* *Paper read before the Institution of Mechanical Engineers.*

not accuse him of wishing to depreciate the efficiency of Mr. Wyllie's engines when he told them that if the diagrams exhibited had been combined on his plan, the efficiency would have appeared much greater than as shown, and much of the discrepancy between one set and another would have disappeared.

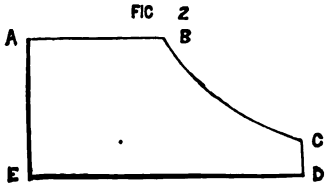
The first point to which he particularly wished to call attention was that in any engine in which there was compression he considered the theoretical diagram used as a standard of reference for the actual diagrams should not include the whole of the clearance, but only so much of it as had to be filled with new steam at admission after compression had taken place. The other point had reference to the placing of the second and third diagrams. At the Leeds meeting Professor Kennedy stated that



FIC 1

if all the clearances were shown from the vertical line, as was done in the combined diagrams shown in the paper, all the diagrams would naturally fall into their proper places in relation to the expansion curve; and he understood him to agree with the plan adopted in the paper of making the expansion curve of the theoretic diagram, such as was due to the whole steam in the cylinder including clearance. He thought he could make his objections to these methods clear by sketches on the blackboard —which we reproduce. In the method adopted in the paper, and agreed to by Professor Kennedy, having drawn *a c* Fig. 1, *a b* is set off to represent clearance in H.P. cylinder, and *b c* the space passed through by the piston to the point of cut off. Then *c d* is drawn representing the expansion of a quantity of steam *a c*, including all the clearance. The area of reference in such a theoretic diagram is therefore the area *e a c d*, which he considered was too large, both in the clearance side and on the expansion side. The method adopted by the same authorities for placing the other diagrams within this theoretical area was to set off *f g*

FIC 2

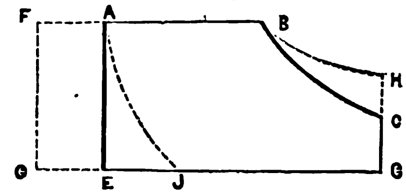


equal to clearance in M.P. cylinder, and *h j* equal to clearance in L.P. cylinder, the positions *g* and *j* indicating where the diagrams should commence. This, he believed, would only be correct for one condition of clearance and compression, and that not a very likely one to occur. Supposing Fig. 2 represented the diagram for an engine having no clearance whatever, and no compression, *a b* is the steam taken from the boiler, *b c* is the curve of expansion of that quantity of steam, and *a b c d e* is the correct theoretic diagram for that engine. Moreover, this diagram represents all the work we can possibly get out of the quantity of steam *a b*, of pressure *e a*.

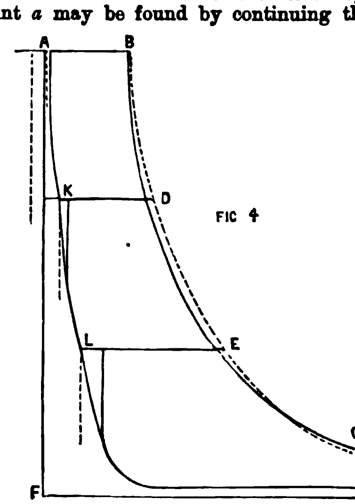
In Fig. 3 *a b c d e* represent exactly the same as Fig. 2. Let us now suppose that a large clearance is added to the engine, but still no compression. The clearance *a f* being added will enlarge the diagram by the area *a f g e*; and since at cut-off the cylinder contains a quantity of steam *f b*, the expansion curve due to that steam will be *b h*; and the area *g f b h d* will be the correct theoretic diagram for this engine, which has no compression.

Let us now suppose that compression is added, so that the steam in the clearance space is just up to boiler pressure at the time of admission, the compression curve being *j a*. The case is now quite different. The engine gets no steam from the boiler in the space *a f*, and we cannot expect any work for nothing, therefore the space *a f g e* requires eliminating from the theoretic diagram of this engine. All the steam the engine gets fresh from the boiler is *a b*, as in the engine represented by Fig. 2; but as the expansion curve is correctly *b h*, due to the steam *f b* in the cylinder at cut-off, it appears at first sight that we have got the area *b h c* for nothing. We shall find, however, that we have had

FIC 3



to give the area *a e j* for it. This compression area is the work done on the clearance steam to enable us to get the addition to the expansion curve above *b c*. The theoretic diagram for this engine with compression should therefore *not* include both *a e j* and *b h c*, and as the latter will in an actual engine never be equal to the former, it seems clear that the proper area of reference for efficiency of steam is in this engine the area *a b c d e*, which is the same as Fig. 2, and which represents the expansion of that quantity of steam received from the boiler after compression has taken place. It is, however, also interesting to show on a theoretical diagram the lines *b h*, as the card should theoretically come up to that line. In making a theoretic diagram for a triple-engine on these principles it will be found that *a b*, Fig. 1, should be only so much of the clearance as is not filled by compression, and the point *a* may be found by continuing the compression



FIC 4

curve of the H.P. cylinder upwards to initial pressure. The curve *c d* should be that due to the fresh steam supplied at each stroke, and in placing the successive diagrams it seemed to him the important point to be noted was the point *k*, Fig. 1, namely, the point where compression began in the previous cylinder. At this point the steam was practically cut in two parts, the part to the left of *k* being retained for compression, and that to the right of *k* being passed on to the next cylinder. If from *k* a vertical line be dropped, and to the right of that be set off just so much of the clearance in the second cylinder as requires to be filled after compression, that point will give the position of the second diagram, and so on with the third also. In Fig. 4 this method is illustrated: *a b* is the fresh steam taken from boiler at each stroke; *b c* is the expansion curve due to *a b*; *f a b c* is the theoretic diagram representing an area of reference for determining efficiency of steam; *b d* is the curve due to all the steam in H.P. cylinder cut-off, including clearance; *d e* is not continuous with *b d*, but is a curve due to steam *k d*, and is the curve to which the diagram should approach; *e g* is again a new curve due to steam *d e*. This he thought a much more accurate method of comparing actual diagrams with theoretic, and put all engines on a fair basis, making due allowances for their clearances and compressions.

Professor RYAN said he felt a little out of place in this discussion, not having served his time in the stokehole or its vicinity, but as Mr. Kirk had told them in his letter that this was a commercial question rather than a mechanical one, he felt that possibly he might be listened to for the five minutes that were allotted to him. The 15 per cent. arrived at by Professor Kennedy was a concession—a very large concession—to the author of the paper. Professor Kennedy's view was that something like 25 per cent. was unaccounted for in diagrams usually, and he therefore roughly conceded 15, and if he did not take 15 in 100, but in 85, well it did not make very much difference. Mr. Morrison, as the representative of the author of the paper, should have been thankful for that amount of concession. Then again, with regard to the method that Professor Kennedy calculated the volumes of the steam by, it appeared to him that it was precisely the method that Mr. Mudd was advocating that he used—that was, that he continued the compression curve upwards and measured the volume of the steam which was admitted into the cylinder, not taking account of that which remained, as it were, in stock. Now, with regard to the paper itself, he saw that the general conditions of efficiency stated were three equalities—firstly, in the range of temperature; secondly, in the initial stress on each crank; and thirdly, in the indicated horse-power of each cylinder. Now, with regard to the equality of temperature, he thought there was some danger of letting that condition be exalted into an article of faith; and in this particular connection he wished to be understood in the sense in which the little girl defined it, "a belief in something which you know to be impossible." Now, he did not see that there was any particular merit in "equality," at least when dissociated from "liberty and fraternity;" and he did not see that when it was connected with temperature, if they could get equality to the very last decimal that it would be worth striving for. Now, what was the reason which animated the author to aim at equality of temperature so far as one could gather from the paper? It was in order to divide the range of temperature between the three cylinders, so that no one of the cylinders should have an inordinate range of temperature. He did not think it was proven by any means that inequality in the range of temperature caused any large amount of evil. If the condensation was proportional to the first power of the range of temperature, he thought there could be no reason why it should not be unevenly divided amongst the cylinders; but if, as there seemed some reason to believe, it varied as some other function of the range of temperature, then, perhaps, there would be a slight advantage in equality. But now arose the question whether the equality of temperatures affected anything else; and he thought that there was a very close connection, in theory at all events, between the equality of temperatures and the equality of horse-powers. In the discussion which took place at Leeds he found that Professor Smith was credited with having made a statement on this point which read thus: "The three equalities enumerated at the commencement of the paper as general conditions of efficiency, while all desirable, appeared mutually incompatible; but if equality of mean total pressure were substituted instead of equality of initial total pressure, then this equality, together with equality in range of temperature, would include the third equality of indicated horse-power." Mr. Morrison had that evening, he thought, endorsed that view to a certain extent; at least to this extent, that horse-power equality depended on temperature equality, and on the pressures; but he rather inclined apparently to the initial total pressure than to the mean; and then he made some criticisms on Professor Smith's remarks, which he—Professor Ryan—had not time to answer. But what he wanted to point out was that he was going to sin even more than Professor Smith did, and to cut out that mean total pressure condition altogether; and to say that, theoretically at all events, the equality of temperatures should depend solely and wholly on equality in the horse-powers. Now he said that theoretically. He did not mean to say that it was so absolutely in practice, but then they must compare the practical results with the actual theoretical relations, or else they would be lost entirely in their efforts to obtain a solution of the problem. Now, if the triple-expansion engine were a perfect engine, which, of course, nothing terrestrial was, and he supposed nothing marine either, then that relation would obtain. If the triple-expansion engine were a reversible engine that would be the case. He meant reversible in academic slang, not in the phraseology of the stokehole, because he supposed all their vessels had reversible engines, except, of course, the line of battle ships—they did not seem to have any means of going backwards. Now he would say further, in expansion of that statement, that the equality of horse-powers carried with it as a consequence the equality of temperatures if the engine were perfect, but of course the engine was not perfect, and very far from perfect. The only thing he would say was that in so far as the triple-expansion engine functioned reversibly, and as far as the same defects existed in all the cylinders, so far would he expect the equality of temperatures to be connected with the equality of horse-powers. He had cast his eye along the diagrams on the wall, to which he appealed in support of the fact that the relative value of the initial stresses did not in any way affect the connection between range of temperature and horse-power. Then he would go on to refer to those calculations of Professor Kennedy, which had caused so much discussion. With regard to those calculations he would like to say that it appeared to him they might cut both ways. They might be interpreted to mean not that the evaporative power of the fuel was too great, but that that which Professor Kennedy did not believe in, namely, that there was very little condensation in the high-pressure cylinder, was true. If that were admitted, then his 15 per cent. fell to the ground, and they had a nearly normal case. It was the opinion of some people, and it was an opinion he should like to support to-night, that the condensation in the high-pressure cylinder was of very much less account than the condensation in the other cylinders. As the time was so limited, he must touch upon these points very rapidly. He gave Professor Kennedy the benefit of one point, which was that they might take all Mr. Wyllie's diagrams, and they would see that the temperature range was greater in the low-pressure than in the high-pressure, and yet at the same time the horse-power of the low-pressure was less than that of the high-pressure. Now, they knew that the low-pressure was steam-jacketted in Mr. Wyllie's practice, but the high-pressure was not; so that the high-pressure, with a smaller range of temperature and without any steam jacket, gave a much greater efficiency than the low-pressure in every diagram on the wall with one exception, and in that case there was something like 37 per cent. range of temperature greater in the low-pressure and only something like 22 per cent. gained in the horse-power; so that it was quite clear that the efficiency of the high-pressure cylinder was much greater in Mr. Wyllie's engines, at all events, than that of the low-pressure cylinder. He would point out that the condensation depended upon (1) range of temperature; (2) area of cylinder exposed to steam; (3) the weight of metal concerned in the thermal changes. No. 3 depended on (1) conductivity k; (2) specific heat c; (3) time of alternation of temperature T. In fact No. (3) varies as $\sqrt{\frac{k\,T}{c}}$. Professor Kennedy considered that the high-pressure cylinder was the unruly member, and as such that it ought to be jacketed. The following were some of the reasons for disagreeing with Professor Kennedy's view that the high-pressure cylinder should be steam-jacketted rather than the low-pressure cylinder. He assumed throughout equal ranges of temperature in the cylinders and efficient lagging:—(1) Suppose the range of temperature was the same in the high-pressure cylinder, yet any one of its cylinder covers is exposed to the cooling influence of expansion during three-quarters of a revolution only if the cut-off be at half-stroke. (2) The area of the piston and of the end of cylinder is a larger fraction of the area of the sides of the cylinder in the low pressure than in the high, and these end areas are exposed to the steam throughout the whole stroke. (3) Greater condensation will take place in the low than in the high, because the proportion of the area of surface relatively to the weight of steam in the cylinder is greater in the low-pressure cylinder. This is evident, because the weight of steam passing through the three cylinders varies but little. (4) A larger weight of the cylinder will be active in the thermal changes in the low pressure than in the high, because the area exposed is greater. (5) Condensation lubricates the piston in the high-pressure cylinder, and this dispenses with the oil and its consequent evils at high temperatures, and in the feed-water. (6) Condensation matters less in the high-pressure, because all the condensed steam is re-evaporated into the next cylinder, while in the low it is passed into the condenser. (7) The steam jacket is partly idle during admission in the high-pressure and very little use with the ranges of temperature used in triple-expansion engines, considering the high mean temperature in the first cylinder. On the other hand the steam jacket will be very effective all the time when on the intermediate or low-pressure cylinders, because of the considerable gradient of temperature between boiler steam and steam in the second and third cylinders. (8) The steam gets wetter and wetter as it passes through the cylinders. (9) The evidence of Mr. Wyllie's diagrams that the unjacketed high-pressure cylinder is much more

efficient than the jacketed low-pressure cylinder, taking account of the relative ranges of temperature.

Mr. Mair said he thought the thanks of the Institution ought to be given to those who represented the author of the paper, because he had given them—if he might use a foreign phrase—his inside practice, for which he thought they ought to be exceedingly obliged and grateful. They had also to thank Mr. Cochrane for having said at the last meeting that the statement of the pounds of coal used by engines was an utterly valueless statement. An engine did not use coal at all, it simply used steam, or rather it used heat, and they ought to know how much heat the engines used, and then they would be able to tell how much and at what efficiency the engines stood. There was no doubt at all about this fact, that those three-cylinder compounds were more efficient than the two compounds, for this reason. He did not think there was so much in the range of temperature as the various speakers seemed to imply. If they looked at the temperatures they would find that with the *Anglian* the range of the temperature with the ordinary two-cylinder compound was 70 and 75, and in the triple it was 71, 71, and 79, a very small portion indeed. Again, if they looked at the *Lusitania*, there the range of the temperatures for the two-cylinder compound was 71·9, 72·78, and for the triple it was 71, 68, 76, so that there was not very much in the range of temperature there. The plain, simple reason why the engine was more economical than the other was the fact that it was not convenient in a marine engine to have more than 60 lb. of the high pressure in the cylinder for various practical reasons. As regards the number of expansions that could be made in an ordinary compound engine, if they took a boiler pressure of 60 lb. of steam, with 9·2 expansions, they got thermal units, 334.

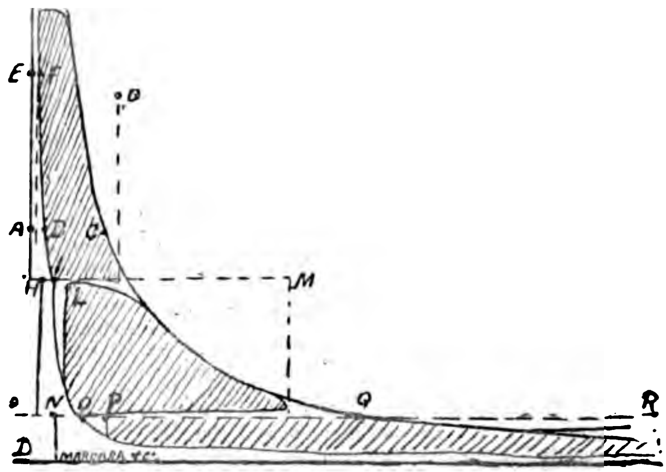
Lbs.	Expansion.	Thermal units.
80	13·2	327
100	14·1	325
120	13·7	330

That showed that if they had passed somewhere about 10 to 12 expansions, say 11 expansions, there was not much economy in going on with two cylinders at no higher rate of expansion, and then he thought the triple would come in; and he thought they had not yet given the requisite number of expansions to obtain all the economy that could be obtained from using a triple-expansion. As to the heat, that was given up by the steam jackets of the engine first of all, but did not think that with these engines at C there was very much advantage, where the range of temperature was small, in putting on jackets. Undoubtedly economy would exist by using jackets, but the question was whether it was worth the trouble and the bother of using them. The stokehole was not a very nice place for making bulky experiments in, and even on shore they had engines with their jackets choked up with water, and it was a question if it was worth the trouble and expense of putting them on. That was a commercial question. As regards the heat, that was given up in the jackets of the engines. He saw that there was a statement made in one of the papers before the Institute, that the steam that was condensed in the jacket merely gave up its internal heat. The way in which M. Regnault made his experiments was this. He had a boiler in which he evaporated water at a constant pressure, and he put in his calorimeters and he condensed the steam with cold water. He measured the amount of rise of temperature in his calorimeters in connection with the quantity of water passed through, and found that he had got the total heat of the steam, that is to say, not only did he get the internal heat of evaporisation, but he also got the heat due to extra work. That is what M. Regnault found, and that is exactly what goes on in the jackets of an engine or in any other form of condenser. It did not matter whether the steam was going through the cylinders of an engine or whether it was being condensed in a jacket, it gave up its total heat exactly in the same way.

Mr. Halpin said he thought they had greatly to thank the author for the paper. It was on compounding applied to marine engines, and he hoped it would be followed by a similar paper by someone on the stationary engine, which would make the cycle perfect. With regard to the question of steam jackets, he certainly must say that he believed in jackets, and particularly in those marine engines where they all found it so advisable and so advantageous to use the liners. When they used a liner, what objection there could be to turn the space into a jacket he failed to see. They had an enormous advantage in the ordinary marine engine like those mercantile engines, that in all cases they had a fall of 6 ft. or 8 ft. between the bottom of the cylinders and the boiler, so that the jacket in that condition would easily drain itself. He did not at all agree with the statement that was made by the speaker in the discussion, that the jackets wanted very careful looking after at sea. If they simply put a separate pipe on to them and a separate pipe back from them they would look after themselves. He looked upon the jacket in this particular place in the same way as he looked upon the bed plates. They had to look after the bed plates in the sense that they wanted tightening, and they looked after this jacket in the same way. He tried to trace in the same way what made the efficiency in various cylinders, and he did not know that he had succeeded in doing it. They had given them the cylinders of the *Para*, in which they got the diameters, the stroke, and the total mean pressures—observe, not the effective mean pressures, but the total mean pressure. Of course they got the heat available inside the cylinders, and they knew the total pressure inside the jacket was constant. From that they could get a co-efficient which might possibly give them a rough approximation as to the value of the jacket, as between 4·2 and 11·13. He thought that great thanks were due to Professor Kennedy for taking up this matter of the water. He did not know how he had calculated, but when he had given such a liberal co-efficient as 15, such a very low co-efficient as 15, and then brought out an average result of 12·88 of evaporation, which was the mean of the whole of his experiments, it is clear their thanks were due for showing that. If the Committee appointed by the council were going to make experiments—and he hoped they would—he ventured to suggest that they use meters. He did not say any form of meter was absolutely accurate, but they all knew meters were accurate between 3 or 4 per cent., which was a very long way short of 25 or 15 per cent., which Professor Kennedy gave him, and if they used a meter if anything broke down they need not stop. They would certainly get a very much closer approximation than they could get in dealing with a body like that. They had only got to deal with 1,000 gallons of water at the outside, which was a very small matter to deal with in a meter. If they wanted to make the thing more perfect they might put another kind of meter on, an inferential meter on the discharge water, from which he thought they might get very valuable results, if not very accurate. The results commercially would be this: they would see whether it would be cheaper to drive a larger volume of water through a certain money value of brass tubes or the reverse, and what was the best thing to do in their condensers. In this paper there was another thing that had not been alluded to that he thought should be noted. All the coal was not weighed; only one-seventh of it was weighed, and the other six-sevenths they measured in some way in skips. That would give rise to far greater errors than if it were possible to weigh the whole of the coal, which, he thought, would have been a very much better thing. In connection with these experiments, Mr. Mudd, he saw by the papers half-a-year ago, made some exceedingly valuable experiments, putting a whole engine on a bed-plate and working it; but there he soon got to the end of his tether. He could only get friction diagrams, but he thought that with a very slight additional expense he could have got an additional load on the engine. Professor Thurston, in America, took up 500 H.P., and then he was not within miles of the limits of his power, so that he thought that a thing of the size he used would be an exceedingly cheap thing to rig up, and infinitely more accurate experiments could be got than at sea. The feed-water was measurable on land and perfectly under control. When he came to the question of ports, he found it a question of compromise, but those diagrams showed it very effectively, not alone what the actual port area was, but also what the valve opening was at the same time. One word he would say with regard to the figures the author gave of a vacuum. He gave for the whole of those a vacuum of 27 or 27·5, whatever it might be, but that under the circumstances was a statement which was not of the value it might be, because the barometer was not given. The barometer should certainly be given, and then one would know what was being done. He would further suggest that instead of giving a vacuum, and instead of giving the barometer if the vacuum was 27 and the barometer was 30, if they gave a co-efficient of 9, that was all that was wanted—one knew what had been obtained, and that was translatable all over the world, instead of having millimetres by one certain vacuum to keep the whole thing shown. With regard to the three cranks, of course, as far as turning moments went they were very nice things, and kept a very easy action on the engine. When one looked on the engine and saw that three cranks had to be accompanied by suitable bearings, the question was not altogether so simple. They could get those bearings true with a bar—he was willing to allow that they could get them in, and that they got the bearings true, but whether they could easily keep them true he thought would be very doubtful and very difficult.

Mr. Seamington said he wished to speak with reference to Figs. 5, 6, and 7 (see page 293, Vol. 8, of the Marine Engineer). He thought there was there shown a little experience which would be of great value to marine engineers. They would see on No. 5 there was an initial pressure of 120; No 6, 130; No. 7, 140; and he believed in each case the boiler pressure was the same. Now, he believed that the defect in No. 5 was due to some bends in the steam pipe, and probably it was an improvement when those bends were taken away. No. 7 represented the same size engine, but probably with different pipes; he would like to ask if Mr. Morrison would give them the size of the pipes, and any particulars of the fittings there, because his experience with those engines was that the difficulty arose, especially with high speed engines, from not knowing in the matter of steam ports what not to do—not so much what to do as what to avoid. There were also Figs. 10 and 11, where an increase of 10 or 11 revolutions was obtained, but the back pressure was increased 1½ lb. Having to do with engines from a great number of different makers, he found there was a very great difference in practice, and if they could only get hold of those particular cases, which might be called the comparative failures, it would be of very great service to them. Upon the question of jackets he would only say that with high-pressure cylinders a loose lining was particularly desirable, because the wear was sometimes very great, and it always gave facilities for renewal. But upon the question of piston speeds he would like to say a few words, because those three-cylinder engines that were now becoming so popular certainly did give a well-balanced engine, and the advancing use of steel gave also a material which admitted of higher piston speed, without an increase of wear and tear; and he ventured to think with a well-balanced engine, and with the material now coming into use, more particularly that higher piston speeds might be adopted with great advantage and without much, probably without any, perceptible increase in the wear and tear. Of course they wanted a first-class working ship with a high speed, but a high piston speed allowed them to use a much smaller engine and power, therefore they got some diminution in the first cost, which, of course, was always a consideration, and they got less weight and less space, and he believed also more practical working, than with those high-pressures that were now used. To his mind it was a matter of regret that the invitation of Mr. Morrison to discuss the artificial or forced draught question had not been responded to. He was quite sure that marine engineers generally were considering the question as of more importance than any manipulation of indicator diagrams. Of course in warships the forced draught was used for a very different purpose from what it would be generally used in the mercantile marine. There, by adding a few pounds of air, sometimes they got 50 per cent. more power out of the boilers, with only 10 per cent. more consumption of fuel; and of course, as the highest power was only required for short periods of time, and on very few occasions, the increased amount of fuel was not a serious drawback; but in the mercantile marine, what must be had there if the forced draught was to become the general practice, was a diminution of consumption of fuel without any deterioration of the boilers, and he thought if they could have some information on that point, and as to the durability of the boilers that often worked with forced draught, he was quite sure it would be most acceptable to marine engineers.

Mr. Schönheider referred to the mode of putting the diagrams together both of the two-cylinder and of the three-cylinder engines, because he found that there was a great diversity of opinion as to how they should be put together, and this evening he had heard for the first time from Mr. Mudd, as an approximation, how it should be done, but he thought that Mr. Mudd was a little astray on one point, and that was the expansion curve. If he understood Mr. Mudd rightly, he said, or meant to say, that an engine with a given sized cylinder, with a given amount of clearance, if there were no compression in the engine, they would get a certain expansion diagram. If they had compression they got a different expansion curve. That was incorrect. The expansion curve was quite independant of the compression in the cylinder. Before making compound engines, whether two or three cylinders, it was necessary that they should match the diagrams in order to know exactly where there cut-off was to be, where their compression was to be. If they did it, it must be correctly done. It was no use to measure with an india-rubber rule. In referring to the diagrams, there was one which showed a small cylinder with an expansion curve, and also a compression curve going up to a certain height. Now, if they put in the diagram a horizontal line A C, then the volume H B would represent the amount of steam which was compressed back into the clearance spaces. Volume A C was the total volume which expanded in the cylinder, and the difference between the two, that was to say, volume B C, is that volume which passed through the cylinder and which exhausted from the one cylinder and passed into the other at the pressure, of course, of B D. The same thing took place in the second cylinder. There they had H M the volume of the cylinder, H L was the volume of the clearance, but the amount of steam which passed into that cylinder and also passed out of it was the steam marked by the line I K. That was the steam measured by horizontally cutting it at any point lying between the expansion curve and the compression curve, in the same way with the low pressure cylinder. Then N R was the volume of the low pressure cylinder. N P was the volume of clearance. N was the amount of steam which was compressed back into the low-pressure cylinder, and O Q was the volume of steam which passed through that cylinder. It was the same volume which was exhausted from the little cylinder, and it



went up into the larger cylinder. He would further say that the expansion of the curve for the small cylinder should be set from the clearance, also passing through E, because it was the total volume in the cylinder and clearance spaces which expanded and came through that curve. In the same way the compression curve should be set off in the same line. The expansion curve should be set off from the vertical line passing through H, because it was the volume H K which expanded in the cylinder in the same way as the volume in H I which was being compressed from that cylinder, and the whole expansion from the curve of the cylinder was not necessarily a continuous curve. It might have brakes—it might have humps upon it, or it might be hollow. He did not think Mr. Mudd could say in excuse that he had not seen this published in any book, as, early in 1871, he published in Engineering a diagram of expansion, showing how these diagrams should be put together, and in this Institution, about three or four years ago, he also gave them an illustration.

A Mariners' Institution for the Tyne.—An effort is being made by a number of gentlemen resident in the borough of Tynemouth to signalize in a special manner this the jubilee year of her Majesty's reign by the establishment of the Tyne Mariners' Institution. The project is not now under consideration for the first time, but existing circumstances are said to be so favourable as to cause the promoters to entertain the belief that the present eventful and memorable year will witness its realization. A scheme has been drafted which proposes the re-constitution of the Tyne Master Mariners' Asylum, and its amalgamation with the Tyne Aged Scullermen's Fund, and the establishment of an institution for the benefit of infirm master mariners, merchant seamen, scullermen, engineers, and firemen of sea-going trading vessels or their widows. The scheme provides that the abovenamed persons shall have the privilege of occupying, gratuitously, free of all rates and taxes, such accommodation in the institution as, in the opinion of the committee, their needs may require; that annuities be granted of such an amount as the funds of the institution will permit and at the discretion of the committee, whether such persons reside in the institution or otherwise.

INDUSTRIAL NOTES.

THE CLYDE AND EAST AND WEST OF SCOTLAND.

THERE is very little—if anything—of an encouraging nature to notify regarding Clyde shipbuilding and marine engineering for the past month. The depression seems to be more keenly felt than ever, although doubtless a rift here and there presents itself in the dark cloud to show the proverbial "silver lining" behind it. The vessels on the stocks at the beginning of April, including new keels, amounted to 72, the estimated gross tonnage being something like 128,000, compared with 86 vessels and 135,000 tons at the corresponding period in 1886. The most important vessel under construction on the Clyde at present is the North German Lloyd Atlantic liner in the yard of the Fairfield Shipbuilding and Engineering Company. Her contract speed is to be something like 20 knots per hour. The London and Glasgow Shipbuilding and Engineering Company, of Govan, in order to keep matters going in their large establishment have started the construction of a steamer of 3,000 tons to be built on their own account.

Messrs. Blackwood & Gordon, shipbuilders, Port Glasgow, have issued a circular to their creditors announcing that "in consequence of the state of trade and other circumstances" they have found it necessary to stop payment. They suspended operations in their shipbuilding yard on the 9th ult., notice being then given to the workmen that work would not be resumed on the following Monday. This firm commenced shipbuilding in Port Glasgow about a quarter of a century ago, and during that time they have carried on an extensive trade. Their works, including engineering as well as shipbuilding, gave employment to a large number of workmen, and have for some years been the principal source of employment in the east end of Port Glasgow. They have at present in course of construction only one large steamer of over 2,000 tons, and there is at present lying in their dock for sale a new steamer, named the *Eagle*, which they recently built to their own account. This suspension of labour is all the more to be regretted as trade in Port Glasgow is very much depressed.

Two large screw steamers which have been on the stocks of Messrs. Alexander Stephen & Sons, Linthouse, for a considerable time—which have been ready for launching in fact for about nine months—have been sold within the month to a Glasgow company whose vessels trade between this country and India: understood to be the British India Steam Navigation Company. The vessels are 360 ft. long by 47 ft. broad—a remarkable beam—and are said to be able to carry the enormous cargo of 5,000 tons. Some alterations are being effected on the vessels to adapt them to the service intended, after which they will be handed over to the purchasers.

The British India Company, it may be stated, have lately ordered two additional screw steamers from Clyde firms; one from Messrs. A. & J. Inglis, Pointhouse, who are at present finishing a handsome paddle steamer for the same company, and the other from Messrs. W. Denny & Bros., Dumbarton. They are slightly smaller than their usual type of steamer—being 240 ft. in length—and of course will be built of steel.

A contract has been secured by Messrs. Russell & Co., Port Glasgow, to construct a large iron screw steamer for the Central American cattle trade. The order for the engines has been booked by Messrs. Kincaid & Co., Greenock.

The Ferries Committee of the Clyde Trust have set aside the resolution come to at a previous meeting regarding the re-engining of the small river passenger steamers *Cluthas*. It has been arranged that in order to improve upon the wasteful and inconvenient type of single engine at present fitted in the vessels, the fitting of compound engines should be adopted, and it was decided to have only one of the vessels fitted for a time at first, in order to see the result. This determination, however, has been departed from in favour of a proposal to fit engines of the now almost universally approved triple-expansion type. An offer by Messrs. Walker, Henderson & Co., to provide triple-expansion engines with boilers to suit, for the sum of £540 each boat, has been accepted, only one vessel to be proceeded with in the meantime. It may be stated that Messrs. Henderson & Co. have successfully applied their system, which has some material advantages over some other kinds of triple-expansion, to the *Curlew* belonging to Messrs. Hay & Co., of Glasgow. This vessel has been fitted against the *Snipe*, a similar vessel owned by Messrs. Hay, but having the ordinary compound engines, the results showing a marked superiority for the triple-expansion engines. The Messrs. Hay, it is understood, are so convinced of the advantages of triple-expansion engines, even for small vessels, that they simply await a favourable opportunity to convert the engines of all their other vessels to the new system.

Messrs. A. McMillan & Son, of Dumbarton, have succeeded in finding purchasers for the large steamer *Balmoral Castle*, which was burned at sea about 18 months ago, and which they brought to Dumbarton for renovation. The alterations and repair work on this vessel have been very extensive and heavy. She has, however, been thoroughly overhauled, re-classed, and made equal to a new steamer, and left the builders' hands on the 6th ult. This firm is now nearly at the end of a somewhat lengthened spell of work, and it is rumoured they may dispense with a good portion of their staff shortly. On the 9th ult. they launched the second of three sister vessels for the Greek Royal Mail and Passenger Steamship Line, for trading throughout the coasts of Greece and adjacent seas, with which they have been occupied for some time. The name of the vessel is the *Thrace*, the previous one being the *Ionia*, and the one remaining, still to launch, the *Albania*. They are fitted with engines of the triple-expansion type by Messrs. David Rowan & Son, and are to be fitted with all modern improvements for comfort and economy, including the electric light.

The riveters and holders-on employed at the shipyard of Messrs. J. & G. Thomson came out on strike about the middle of April, but resumed work some days after much on the same footing as before. The dispute arose in that for some time a patent furnace, invented by their foreman, Mr. W. Miller, has been in operation at Clydebank, and effects a saving in the number of boys employed heating rivets, one boy being able to keep three squads of men at work. The workmen complained, however, that the rivets were not sufficiently heated, and entailed on them considerably more physical labour and time than if they had been heated thoroughly, and that by this their wages were very much reduced. Mr. Miller, the foreman in question, wrote to one of the Glasgow dailies to correct a report of the circumstance which it has published; in his letter he says: "My object in introducing these furnaces was a desire to make the work more efficient, and also a saving in wages by getting one boy to heat for three squads, and I maintain that in both I have succeeded." He further says that the quality of the work is so much improved that there is only one rivet found slack now for every 20 formerly, and that the complaint as to smallness of wages is totally wrong. In proof of this he submits a list of the wages paid to the riveters just before the strike, from which it appears that in the cases of 11 squads, the wage earned by each riveter ranged from 11½d. per hour to 7½d., and by each holder-on from 8½d. to 5½d. per hour.

At a meeting of the shareholders of W. B. Thompson & Co., Limited, shipbuilders and engineers, Dundee, held in that town on the 22nd ult., it was reported that the business had been so recently taken over as a limited liability affair that the directors were unable to report regarding probable profits, but both shipyard and foundry were fully employed, and materials having been bought at low rates, the directors had every reason to believe that the work on which the company was engaged would prove fairly remunerative. There had been several enquiries for new vessels, and the directors were hopeful that some of these would soon result in further orders being received.

About the middle of April the last of the blast furnaces at Quarter Ironworks, near Hamilton, was blown out, never, it is feared, to be relighted. This is the disappearance from the district of Quarter of an important industry, and is the direct result of the depression in the iron market.

Some time ago a lengthened correspondence took place in the Glasgow daily press on the subject of signalling at the steamboat piers on the Clyde, and the irregular and highly dangerous practice of steamers racing to secure first place. The correspondence bore good fruit in the shape of an intelligible and systematic code of signalling, which when enforced must greatly lessen, if not altogether obviate the dangerous practice. Now a further subject of great concern to the public travelling on board these vessels is under review, as indeed it has been regularly every season for five or six years past. This is the matter of over-crowding. Cases of gross and perilous over-crowding are very frequent during the season, and unless stringent measures are taken to see that the numbers which these vessels are legally empowered to carry are not exceeded, very calamitous results may ensue.

Several well-known and favourite Clyde River steamers will be missed during the incoming summer. Some time ago the

Ivanhoe was disposed of to distant owners, and now it is announced that the *Waverley*, belonging to Captain Robert Campbell, has been chartered for the season by a Bristol company, and will be employed during the summer carrying passengers from Bristol to places on the Channel. The *Waverley* was built two years ago by Messrs. McIntyre & Co., of Paisley, and engined by Messrs. Hutson & Corbett, Glasgow. She is a fine weatherly boat and should prove highly suitable for her new station.

The screw steamer *Thames*, the second of the two swift vessels which Messrs. A. & J. Inglis have built for the Carron Company's new passenger service between the rivers Forth and Thames, was tried for speed a few days ago and found to equal the performances of her sister ship the *Forth*. This vessel, as reported in our last number, attained the gratifying mean speed of 15·18 knots, with about 400 tons deadweight cargo on board, over an extended series of runs on the measured mile. The Edinburgh and London Shipping Company, with whom the Carron Company are entering into competition, possess several very speedy vessels, notably the *Iona*, built by Messrs. J. & G. Thomson, of Clydebank, three years ago; but not content with this, in view of the step taken by the Carron Company, they are having a new vessel from Messrs. Thomson. This is the *Meteor*, launched several weeks ago, and which will be tried for speed during the ensuing fortnight. As her name suggests, she is expected to give a good account of herself as regards speed, and the coming season is likely to witness a keen bit of running between the vessels of the two companies.

By the inauguration of a scheme of improvements on the river Cart, for which Parliamentary powers were some time since obtained, great good is expected to result to the town of Paisley and its numerous industries. In the present condition of the river there is only a depth of 9 ft. at high water, and this has seriously hindered the dispatch of the numerous manufactured goods for which Paisley is famed. Thread, starch and corn-flour manufactures will largely benefit from the facilities in dispatch which will be conferred when the Cart is made navigable for large vessels from the very threshold of the various works to the junction of the Cart with the Clyde. Amongst the industries which will most largely be benefited by the projected improvements are those of shipbuilding and engineering. Messrs. McArthur and Company sometime ago secured a contract for the construction of a screw steamer which was to be shipped in sections to Rangoon. Owing to the limited draught of water it could not be shipped on the Cart, and had to be sent out of Paisley for transhipment on the Clyde, and Messrs. Bow & McLachlan are under the necessity of doing much the same thing at the present time. The operations of Messrs. Fleming & Fergusson have hitherto been confined to the construction of dredgers and other small class of vessels, though they have often had the offers of contracts for ships of greater dimensions, which they were forced to refuse on account of the limited depth of water between their yard and the Clyde When the river is deepened, however, it is highly probable that they will be in a position to extend their operations, and by so doing give employment to a large number of extra workmen. They are at present engaged in the construction of a yacht of between 300 and 400 tons, which will require to leave the Cart as a mere shell before receiving its engines or any heavy fittings. Great inconvenience has hitherto also been experienced by the engineering contractors, whose works are situated on the banks of the Cart, owing to the want of proper facilities for removing their heavy castings when finished. Messrs. Bow and McLachlan have lately been negotiating with Messrs. Hay and Sons, Glasgow, with a view of getting a light screw to come up the river and load at their works with heavy castings to be sent to London, but this was found to be utterly impracticable with the present draught of water. This firm, and also that of Messrs. Hannah, Donald & Wilson, are large engineers and exporters of heavy machinery, and it is more than likely that when the deepening operations are finished, these and other local engineering firms will secure the orders, which are at present being placed elsewhere, owing to the unsatisfactory condition of the river.

It is announced that the directors of the Ardrossan Harbour Company have settled the contract for the extension of these important works, and that operations will be commenced this week. The expenditure under the contract will be about £160,000, and the Company has entrusted the works to Mr. George Lawson, of Rutherglen. The works have been designed by Mr. Strain, C.E., Glasgow, with the view of giving accommodation for a large increase of trade, and so as to admit of future extension. The new works will consist of a wet dock of over nine acres in extent, with a depth at high water of 27 ft., thus allowing vessels of the largest tonnage to be afloat at all times. Outside this dock a tidal basin of nearly five acres will be formed, with a depth of 18 ft. at low, and 27 ft. at high water. The existing harbourage at the harbour is to be greatly deepened and enlarged by constructing new quays and quay walls. A new breakwater of 2,000 ft. in length is also to be constructed for the safer shelter and anchorage of vessels.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The shipbuilding trade of the Tyne has not shown any tendency towards further improvement during the month of April; no more than two or three new orders have been placed with the builders, and the quantity of work on the stocks has certainly not increased. The launch of the ironclad *Victoria* (previously known as the *Renown*) from the Elswick yard is the most important incident of the month. The yard was fortunately not left absolutely empty by the event, as the framing of a large cruiser (the only vessel now on the stocks) has just been commenced. It has been stated that this vessel was ordered by the Italian Government, but there is reason to believe that this is not the case, and that the vessel, instead of being built to order, is simply put down as a sort of speculative experiment on the part of the builders. It is said that the intention is to make the vessel capable of beating all records in the way of speed, and little doubt is entertained that the company will be able to successfully carry out this design. The Low Walker yard belonging to this great firm offers a marked contrast to their Elswick establishment. While at the latter place only one berth is occupied, at the former nine are engaged, this being the total number of berths in each of the yards. This may be characterized as a unique distinction, for it may be safely said that at this moment no other shipbuilding establishment in the world has so large an amount of tonnage on the stocks. The firm have several other steamers to build, and it appears to be certain that there will be no dearth of work in the yard for at least twelve months. Messrs. Richardson, of Low Walker, have a large vessel in course of framing, and two others that are nearly ready for launching. As no preparations for launching are being made however it would seem that the vessels are unsold, or that the owners are in no hurry to receive them. Messrs. Wood & Skinner, of the Bill Quay yard, have proved their capacity for rapid production, as they have a small vessel, the construction of which was only commenced some five or six weeks ago, nearly ready for launching. A second small vessel is in frame, and the preliminary work of a larger one is being proceeded with. At Messrs. Swan & Hunter's, and also at Messrs. Hawthorn & Leslie's yard, work has been greatly impeded for some weeks past through the inability of steel makers to supply bars, plates, &c., in sufficient quantities to suit the requirements of the builders. Owing probably to the same cause the new yard of Messrs. Stephenson & Co., Hebburn, has not yet been opened for operations. A number of men have been engaged in pile-driving and other necessary work of a preparatory kind, and by the time these notes are in print the establishment will doubtless be under way. Messrs. Schlesinger, Davis & Co. have launched lately a lightship for use, it is said, on the Irish coast. The only occupant of the yard at present is an unsold steamer, which has stood on the stocks since 1883. The firm, however, have secured an order for a vessel of heavy tonnage, and it is understood that this contract will soon be taken in hand. The Tyne Shipbuilding Company have a large vessel, which has been built at the order of local owners, nearly completed, and a second vessel of good size is far advanced in framing. Messrs. Palmer's yard, Jarrow, is still slack, there being only three out of eight berths occupied. The firm, however, do a large business in repairing work, and are generally able to keep both their graving dock and their shipway in profitable employment. Messrs. Readhead have two large vessels in the plating and framing stages, and a third, which was launched a couple of weeks ago, is being fitted out beside the works. The marine engineering works on the Tyne are, almost without exception, fairly well employed. It will be understood, of course, that besides engines for new vessels there are a good many contracts for repair and alteration jobs coming into the hands of manufacturers. An important contract of the latter kind has been recently secured by the Wallsend Slipway Company. Messrs. Hawthorn & Leslie's Engine Works, St. Peter's, have shown some slackness lately, or at all events have not been maintaining the same standard of activity which existed at the end of last year. An improvement, however, now

appears to be imminent, as the pattern-makers employed by the firm are very busy, and they are obliged to utilize other foundries in addition to the very extensive one connected with their own establishment, for the production of the large number of castings required. It was stated in a former report that Messrs. Armstrong, Mitchell & Co.'s Ordnance works were less busy than they had been. The declension, however, has turned out to be but very temporary, and the place now appears to be as brisk as ever. At Messrs. Emerson, Walker & Thompson Brothers' Works, Dunston, the state of business is very satisfactory, the demand for their specialities in shipdeck accessories being well maintained. Messrs. Carrick & Wardale's establishment also continues to be very satisfactorily employed. Messrs. Black & Hawthorn are putting down new machinery to meet the increased pressure upon their resources. Besides a considerable amount of marine and locomotive work the firm have some hundreds of gun carriages to manufacture, and this order alone will keep their place busy for over a year. Most of the leading engineering firms in the district have sent specimens of their manufacture to be shown at the Newcastle Exhibition, which is to be opened on May 11th. The exhibits mainly consist of marine and locomotive engines, tram engines, ship models, heavy ordnance, &c., and with the exhibits that are being sent from distant places, may be expected to constitute an interesting and instructive display.

The Wear.—The state of the shipbuilding industry on the Wear can scarcely be said to be so good as at the close of last month. The only order booked during the month is one for three medium-sized steamers obtained by the Sunderland Shipbuilding Company. One of these is to be a passenger boat, and will be somewhat elaborately fitted out. Messrs. Bartram and Haswell have commenced the plating of a large vessel which is being built to the order of a local company, and it is understood that the firm will have another to lay down in the course of a few weeks. Messrs. J. L. Thompson and Sons have put a large amount of tonnage off the stocks during the last few weeks, and their establishment is now beginning to have a somewhat bare appearance. Three berths out of six are vacant, a state of things which has not been witnessed at that yard for a long period, the rule having been to place a keel in the berth as soon as a vessel was launched. It is assumed, however, that this yard is not likely to be short of work for any lengthened period, as its capabilities for production are almost unequalled, and for many years past it has maintained the leading position on the Wear, not only as regards the amount of work ordinarily on the stocks, but in other respects as well. At the Deptford yard business is also less active, the two berths which were last vacated being still idle. A large force of men, however, are still employed on the American liner *Lake Ontario*, which it is expected will be ready for delivery to the owners in a month from now. Messrs. Short Brothers have just completed extensive repairs to the s.s. *Prinz Albrecht*, and it is understood that they will have some other contracts of the same kind to deal with shortly. Messrs. R. Thompson and Sons, have had a large number of vessels under repair during the month, and have still several contracts of this description in hand. There is little change in the state of business at other shipbuilding establishments, great slackness or total stoppage being the distinguishing feature in each case. There is an improvement in marine engineering, two of the leading establishments which have been very slack for some time having just secured some orders of importance. The smaller works are also showing a tendency towards better business. Messrs. C. & M. Douglas have had the boilers of several steamships to overhaul and repair during the month, among the number being the *Arbutus*, the *Ethel Gwendoline*, &c. Most of the Sunderland shipbuilding and engineering firms, have decided to be represented at the Newcastle Exhibition.

The Hartlepools.—The three yards on the Hartlepools being in operation, and two of them actively so, that shipbuilding centre must still be described as the busiest on the North-East coast. The engineering establishments continue to be well employed, but the local rolling mills are not kept going continuously. The active season in the timber trade is approaching, and already there are appearances of more animation at the docks.

The Tees.—Messrs. Pearse & Co.'s, and also Messrs. Taylor and Craig's yard at Stockton continue to be well supplied with work, but some delay has been caused in the former establishment by the non-delivery of material. At Middlesboro' Messrs. Raylton, Dixon & Co.'s yard keeps busy, but in the other establishments there is not much doing. Messrs. Blair & Co. have recently engined two vessels built for Spanish owners on the Wear, and among orders now in hand is a set of triple-expansion engines for a large vessel about to be built on the Tyne.

LAUNCHES AND TRIAL TRIPS.

We have to thank several correspondents for the valuable assistance they have rendered us by forwarding accounts of launches, trial trips, &c. We wish to make this feature of ENGINEER *as complete and reliable as possible, and will thankfully receive all such information, or accounts of any novelties relating to any branch of the marine engineering trades. To insure insertion, all such favours should be in our hands by the 23rd of the month.*—ED. M. E.]

LAUNCHES.—ENGLISH.

La Vendee.—On March 24th Messrs. R. and W. Hawthorn, Leslie and Company launched from their shipbuilding yard at Hebburn, a steel screw steamer, built to the order of the Compagnie Generale Transatlantique, for their coasting trade. The engines, which are of the triple-expansion type, have been supplied from Messrs. Hawthorn, Leslie and Company's works at St. Peter's. This is the second steamer launched at Hebburn this year for the same company, and, like the sister ship, is built to the highest class at Bureau Veritas. As she left the ways, the vessel was christened *La Vendee* by Miss Falconar, of Newcastle.

Anna.—On March 26th there was launched from Bidston Wharf a twin-screw steam tug, built by Messrs Cochran & Co., of Birkenhead, to the order of Messrs. Hutton & Co., Liverpool. As the vessel left the ways she was named the *Anna*, by Miss Gertrude Eglen, eldest daughter of Mr. W. Eglen, partner of of Messrs. Hutton & Co. The *Anna* has been specially constructed for light draught to cross shallow bars and navigate shallow rivers. She will go out to her station on the West Coast of Africa as soon as completed. Her dimensions are;—Length, 85 ft.; beam, 13 ft.; depth of hold, 8 ft. The vessel will have two pairs of independent compound surface-condensing engines developing 150 I.H.P. The draught with 35 tons deadweight on board will not exceed 5 ft., and the tug will steam nine knots an hour on that draught.

Benita.—On March 26th there was launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt and Co., of Southampton, a steel screw steamer of about 1,650 tons gross register. Length, extreme, 270 ft.; breadth, 34 ft. 3 in.; depth, 21 ft. The vessel has been built to the order of the Linea De Vapour, Serra Bilbao. She has a long bridge extending over engine and boiler space with saloon in front of same, captain's, officers', and engineers' accommodation being under same; crew and firemen under topgallant forecastle. She has four steam winches for working cargo, Emerson and Walker's steam windlass, Donkin and Nicholl's patent combined steam and hand gear, with brass standard on flying bridge, and screw gear in hood aft; anchor crane on forecastle head. The engines and boilers are by the same firm, triple-expansion with cylinders 21½ in., 33 in., and 55 in. diameter by 39 in. stroke. Double-ended steel boiler for constructed for working pressure of 150 lbs. per square inch. During construction the hull and engines have been under the superintendence of Mr. J. Wilkie, assisted by Mr. Scott. The vessel on leaving the ways was named *Benita* by Miss Edith Oswald.

Mourne.—On March 26th there was launched from the shipbuilding yard of Messrs. Edward Finch & Co., Limited, into the Wye, at Chepstow, a finely modelled iron screw tug steamer, built to the order of the Commissioners of Carlingford Lough, Greenore, Ireland. On leaving the ways she was gracefully christened the *Mourne* by Miss Beatrice Olive Rowe, of Gloucester Villa, Tidenham. The dimensions of the vessel are as follows:—Length, 85 ft.; breadth, 19 ft.; depth, 8 ft. 6 in.; and she will be fitted with compound surface-condensing engines of 250 I.H.P., and with a special crab winch, driven by a set of three cylinder engines, for careening buoys, setting moorings, &c., in the Harbour.

Nordenfelt.—On March 26th the *Nordenfelt*, a submarine torpedo-boat, was launched. She is the largest of the kind yet constructed, being 110 feet in length and 13 feet broad. The engines are of the most powerful kind, developing 1,200 I.H.P., and the vessel will have a speed of 19 knots on the surface.

Cabo Perias.—On March 28th the steel steamer *Cabo Perias*, built for the Spanish line of Messrs. Ybarra and Co., of Seville, was launched from the shipbuilding yard of Messrs. Joseph L.

Thompson and Sons, North Sands, Sunderland. The vessel is of the following dimensions, viz.:—Length over all, 260 ft.; breadth, 36 ft.; depth of hold, 23 ft. 6 in.; built on the longitudinal double-bottom system, under special survey for the highest classification. The steel used in the construction is of the Siemens-Martin process, and manufactured by the Consett Steel Company, Blackhill. The main saloon will be panelled with floral designs, the floor being laid with tesselated tiles. Accommodation for twenty first-class passengers, with ladies' cabins, lavatories, and bath-rooms, are most complete and elegantly furnished. The engines, which are of the triple-expansion type, are being built by Messrs. Blair and Co., Stockton, and are of 700 H.P. The deck machinery consists of five double horizontal steam winches, jib crane to facilitate the loading and discharging of the vessel, also steam steering gear, and direct steam windlass with Wasteneys Smith's patent stockless anchors. The masts are of iron, and of the pole description. The whole of the vessels launched by Messrs. Thompson this year are of steel, besides over 10,000 tons of shipping now in progress, three of these being built on the web frame and longitudinal plate intercostal system, thereby dispensing with the hold or orlop deck beams.

Paris.—On March 29th there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel screw steamer, built for Messrs. E. Haslehurst & Co., London, under the superintendence of Mr. G. Eldridge, naval architect, of London, of the following dimensions, viz:—Length over all, 168 ft.; breadth, 25 ft. 2 in.; depth, moulded, 9 ft. 9 in. The vessel is fitted with a long raised quarter-deck, bridge-house, and half forecastle; water ballast at ends, steam steering gear, steam winches, patent windlass, and all modern appliances. As the vessel is intended to trade between the United Kingdom and France, the masts and funnel are arranged to lower to enable her to pass under bridges. The engines are by Messrs. Westgarth, English & Co., Middlesbrough, capable of indicating about 350 H.P. On leaving the ways the vessel was named *Paris* by Miss Maud Hunter, daughter of the builder.

Brampton.—On April 7th from the shipbuilding yard of Messrs. John Readhead and Co., West Docks, South Shields, a handsomely-modelled steel screw steamer was launched, of the following dimensions:—275 ft. by 37 ft. by 19 ft. 11 in. She is classed 100 A1 at Lloyd's. The steamer is fitted with triple-expansion engines, having cylinders of 21 in., 35 in., 57 in., by 39-in. stroke, supplied with steam from two steel boilers, and to work at a pressure of 160 lbs. per square inch. The machinery and boilers have also been constructed by Messrs. Readhead and Co. The vessel has been built to the order of Messrs. Chapman and Miller, of Newcastle, and has been superintended during construction by Mr. G. A. Strong, of North Shields. She was named the *Brampton* by Miss Chapman, daughter of the managing owner.

Cabo Quejo.—On April 7th Messrs. Joseph L. Thompson and Sons launched the steel steamer *Cabo Quejo*, sister ship to the *Cabo Perias*, launched on the 28th of last month. This vessel is built to the order of Messrs. Ybarra, of Seville, and will be fitted with engines of the triple-expansion type by Messrs. Blair and Co., Stockton. The ceremony of naming the vessel was performed by Miss S. Thompson, of Ashville. The *Cabo Quejo* will be fitted with electric installation, having incandescent lamps of 20 candle power, and on completion will be under the command of Senor Zarraga, who has superintended the construction of both vessels.

Flying Swallow.—On April 7th an iron paddle tug steamer, built to the order of Messrs. J. B. Rennoldson and Sons by Mr. J. T. Eltringham, Stone Quay, South Shields, was launched. The following are the dimensions of the vessel:—Length, 108 ft; breadth, 18½ ft.; depth, 9¼ ft. She will be fitted with side-lever surface-condensing engines of 80 H.P., manufactured by Messrs. Rennoldson and Sons. The steamer is named the *Flying Swallow*, and is owned by the Clyde Shipping Company, of Glasgow, for whom Messrs. Rennoldson and Sons have now built a fleet of 33 similar vessels.

Rockcliff.—On April 7th Messrs. Edward Withy & Co., West Hartlepool, launched the steel screw steamer *Rockcliff*, built to to the order of George Horsley, Esq., of West Hartlepool. The dimensions of the vessel are:—300 ft. by 38 ft. by 20 ft. 3 in., and she is fitted with a long raised quarter deck, poop bridge, and topgallant forecastle. Her deadweight carrying capacity will be very large. The main poop and topgallant forecastle decks are of steel and iron, the bulwarks, rails, engine room and cabin skylights, and charthouse are of iron, five steel watertight bulkheads, and she is fitted with Withy Sivewright's patent improved cellular double bottom for water ballast all fore and aft. She is also fitted with four patent steam winches, windlass, two donkey boilers, Davis's combined hand and steam steering gear amidships, right and left hand screw gear aft, and is rigged as a two masted fore and aft schooner with iron pole masts. The cabin accommodation for the captain and officers is fitted up in the poop, and constructed of hardwood. The steamer will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool. On leaving the ways the ship was gracefully christened *Rockcliff* by the Mayoress of Hartlepool (Mrs. T. Richardson, Junr.).

Zarate.—On April 7th Messrs. T. Turnbull and Son launched from their premises at Whitehall, Whitby, a fine new iron vessel. She made a successful launch, and was christened *Zarate*. She has been built to the order of Messrs. Turner, Brightman and Co., London, and her dimensions are as follows:—Length between perpendiculars, 300 ft.; breath, 38 ft.; depth to top of keel, 26 ft. She is classed 100 A1 at Lloyd's, with special survey of hull and machinery; built under the new three-deck rule, with two decks laid. Her engines, which are 175 H.P., are by Messrs. Blair and Co., Stockton. She is fitted with Emerson, Walker & Thomson Bros., Limited, patent windlass.

Matlekovits.—On April 9th there was launched from the yard of Messrs. Richardson, Duck & Co., South Stockton, a finely modelled steel screw steamer of the following dimensions:—Length over all, 270 ft.; breadth, extreme, 36 ft.; depth of hold, 20 ft.; gross tonnage, about 1,890 tons. This steamer, which has been built to the order of Messrs. Henry Briggs, Sons & Co., of Hull, is the seventeenth vessel built for them by Messrs. Richardson, Duck & Co. She is classed 100 A1 at Lloyd's as a steel vessel, has a long poop extending to fore end of bridge, with accommodation for officers and engineers, and a topgallant forecastle for the crew. She is fitted out in every respect as a first class cargo vessel, with all latest improvements and appliances for the easy working of ship and cargo. She has five Roger's steam winches, and Harfield's patent steam windlass and capstan combined. The engines are of triple-expansion type, by Messrs. Blair & Co., Limited, having cylinders 20 in., 33 in., and 54 in. by 36 in. stroke, are expected to to give a speed of 9 knots. The vessel and machinery have been built under the inspection of Mr. Rolland, superintendent engineer. The christening ceremony was gracefully performed by Mrs. H. G. Spence, of Stockton-on-Tees, who named the vessel *Matlekovits*.

Quiam.—On April 9th there was launched from the shipbuilding yard of Messrs. John Blumer & Co., North Dock, Sunderland, an iron twin screw steam barge of the following dimensions:—Length, 138 ft.; breadth, 35 ft.; depth, 10 ft. The vessel has been built to the order of the River Wear Commissioners, and is specially constructed for carrying concrete to the new pier works at Roker. She has two large wells, capable of carrying 150 tons of concrete. The barge will be fitted with two sets of engines (cylinders 11 in. and 20 in., stroke 18 in.), each being complete in itself, so as to work independently of each other. They are of the inverted direct-acting compound principle, and are being supplied by the North Eastern Marine Engineering Company (Limited). As the vessel left the ways she was christened the *Quiam* by Miss Rhoda Beryl Wake, daughter of Mr. H. H. Wake, C.E., engineer to the Commissioners.

Emden.—On April 13th the s.s. *Emden*, which has been constructed for the Yorkshire Coal and Steamship Company, Limited, of Goole, for their continental trade, was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, at Hull. She is designed to embody all the requirements of the service for which she is intended as well as the most modern improvements, and the dimensions are as follows: — Length, 220 ft.; breadth, 32 ft.; and depth, 13 ft. 6 in. She is built to Lloyd's highest class for iron, and has topgallant forecastle, bridge, and poop, a considerable portion of the two latter being available as shelter for deck cargo and cattle, and water ballast is provided in main and after holds. A comfortable saloon, ladies' cabin, and state rooms are fitted amidships under the bridge for 14 passengers, the entrance to which accommodation, together with steering house, are in a house overhead, and the captain and officers are berthed aft under the poop, and the crew forward. The ship will be schooner rigged with two pole masts, and when completed will have a smart appearance. The hatches, winches, &c., are carefully arranged to afford the utmost available despatch in working cargo, and she has powerful steam steering gear of Harrison's make. The engines, which have also been made by the builders, are on the triple compound three-crank system, and have cylinders 21½ in., 34 in., and 52 in. diameter by 36 in. stroke, supplied with steam of 150 lbs. pressure from a steel boiler of large size.

Fee Cheu.—On April 23rd this vessel was successfully launched from the yard of Messrs. Wm. Doxford & Sons, Sunderland. She is 220 ft. by 32 ft. by 20 ft., with flush spar deck, and is fitted as an armed cruiser and cable vessel, and has engines 19½ in., 31½ in., 52 in., and 36 in. length of stroke, capable of driving her 13 knots; the armament consists of two 6 in. Armstrong breech loaders and four small Armtrong in the 'tween decks. She is entirely built of steel and the whole shell plating is of ½ steel plates. She is expected to sail shortly for the China station under the command of Captain Lugar.

Oxford.—On April 23rd Messrs. W. Gray & Co. launched a fine steel screw steamer, 325 ft. long, 42 ft. 6 in. wide, and 27 ft. 7½ in. deep.; sister ship to the *Worcester*, recently launched from a neighbouring berth, and also built for the same owners, the Great Western Steamship Company, Bristol, Messrs. Mark Whitwill & Son, managers; to take the highest class at Lloyd's, and carry about 4,300 tons deadweight in the Atlantic Trade. The vessel is very strong, having two complete steel decks, and a tier of beams in the holds, and the hood-shaped poop, bridge, and forecastle are joined by a shelter deck for cattle. The bottom is constructed on an improved cellular double-bottom principle, and is very strong. Six watertight bulkheads are fitted. Two strakes of shell plating are double at the bilge and top sides above Lloyd's requirements. Two masts will be fitted, having a smart schooner rig. Four hatches are provided, with a powerful steam winch at each, a steam windlass under the forecastle, with capstan above; steam steering gear in house amidships, and screw steering gear aft; two donkey boilers; distiller to supply 4,000 gallons of fresh water per day into large deck cattle tanks, and overflow into fore peak tank, a special donkey pump being arranged to circulate the water. A handsome saloon and cabin accommodation in a large deck house aft. Arrangements of the most approved kind are made for conveying cattle, and Utley's patent ventilators are fitted to ensure a good supply of fresh air to every part. Side coaling and cargo ports are fitted, and everything is provided which can contribute to the safety and efficiency of the vessel. It may be added that the whole of the officers and crew are accommodated in large comfortable rooms in the bridge amidships, having entrances from the top only. The engines are on the three cylinder triple-expansion principle of 1,400 I.H.P., and are constructed by the builders' Central Marine Engineering Works, West Hartlepool. The speed is to be 10½ knots. During construction the vessel has been superintended by Capt. D. Harrison, and the machinery by Mr. R. Cross. The christening ceremony was gracefully performed by Mrs. Mark Whitwill, junr., the vessel being named *Oxford*.

Electrician.—On April 25th the s.s. *Electrician*, which is the fifth vessel built by Messrs. Raylton, Dixon & Co., for Messrs. Thomas and James Harrison, of Liverpool was launched from the yard of her builders. She is a spar deck steamer, built of steel, and intended for the Calcutta trade, of the following dimensions: Length, overall, 337 ft.; breadth, 40 ft.; depth, moulded, 29 ft. 2 in., and has a deadweight carrying capacity of about 4,100 tons, with Lloyd's freeboard. She has a hood over steering gear aft, with long deckhouse, in which is a very handsomely fitted saloon and accommodation for passengers, and is fitted throughout in every way as a first class steamer for this special trade. She will be fitted with engines by Messrs. Blair & Co., Limited, of Stockton, on the triple-expansion principle, of 250 N.H.P., having cylinders 24 in., 40 in., 66 in., and 45 in. length of stroke. On leaving the ways she was christened the *Electrician* by Miss Bolckow, of Marlow Hall.

LAUNCHES—Scotch.

Moulmein.—On March 21st a steel paddle-wheel steamer was launched from the shipbuilding yard of Messrs. A. & J. Inglis, Pointhouse, Glasgow. The steamer is for the British India Steam Navigation Company, and is intended for the passenger trade between Rangoon and Moulmein. As she left the ways she was named the *Moulmein* by Miss Mowatt, of Glasgow. The dimensions of the *Moulmein* are:—Length, 256 ft.; breadth, 31 ft.; depth moulded, 13 ft. 9 in.; with a gross tonnage of about 850 tons. The engines, which will be supplied by the builders, of 2,100 H.P., are on the triple-expansion principle, with three cranks, and are stated to be the first of the kind ever fitted on board any paddle-wheel steamer in this country. Steam will be supplied from two large double-ended steel boilers, with large heating surface and of superior construction, for a working pressure of 160 lbs. Accommodation has been provided for about 2,000 passengers.

Clan Buchanan.—On March 24th Messrs. Russell & Co. launched from their shipbuilding yard at Kingston, Port Glasgow, a four-masted sailing ship of 2,100 tons net register, for Messrs. Thomas Dunlop & Sons, shipowners, Glasgow. On leaving the ways the vessel was named the *Clan Buchanan* by Mrs. Thomson. She was afterwards towed to the James Watt Dock, Greenock, to be fitted out, and when finished she will proceed to Glasgow to load for San Francisco. The *Clan Buchanan* is to be commanded by Captain Jack.

St. Sunniva.—On March 24th a new steamer was launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen. As she left the ways the vessel was named the *St. Sunniva* by Miss Fortescue. The steamer has been built to the order of the North of Scotland and Orkney and Shetland Company, and is intended for the Norwegian tourist traffic, which was commenced last summer by the *St. Rognvald*. She is being fitted by the builders with triple-expansion engines of 1,950 I.H.P., and with two steel boilers having a working pressure of 160 lbs. per square inch.

Fanny.—On March 26th Messrs. John Cran & Co., Albert Engine Works, Leith, launched a steel twin-screw tug, 70 ft. in length, 14 ft. in breadth, and 6 ft. in depth, built to the order of Mr. T. A. Walker, London. The tug, which will be supplied by the builders with two pairs of compound surface-condensing engines 20 N.H.P., was named the *Fanny* by Miss Cran, Leith.

Scotia.—On March 28th Messrs. J. & J. Hay, shippers, Glasgow, launched a screw coasting vessel from their boat-building yard at Kirkintilloch. She was named the *Scotia* by Miss Maggie Gardner, daughter of Mr. James Gardner, of Meiklehill.

Queen Victoria.—On March 30th a large steel paddle-steamer was launched from the yard of the Fairfield Shipbuilding and Engineering Company, Limited, at Govan, being the first of the fleet of steamers for the Isle of Man, Liverpool, and Manchester Steamship Company, Limited, intended for their Manx Line, running between Liverpool and the Isle of Man. The dog-shores holding the vessel were released by Mrs. William Pearce, who gracefully named her *Queen Victoria* in commemoration of the jubilee of Her Majesty, and by her special permission. The vessel is of a particularly fine and handsome model, and has been specially designed for express and mail service, having sailings twice daily during the season in conjunction with a sister vessel, to be named the *Prince of Wales*, at present building, and shortly to be launched from the same yard. The speed to be obtained will be 20 knots on regular service, being equal to fully 23 miles per hour. The dimensions of the vessels are:—Length over all, 340 ft.; breadth, 39 ft.; depth, moulded to upper deck, 24 ft.; gross tonnage about 1,500 tons, and they have been built under special survey of the Board of Trade. There are eight watertight bulkheads, seven of which are carried up to the main deck, and the watertight doors, which are required between the engine and boiler spaces, are fitted with self-closing arrangements, so that they can be closed instantaneously. The upper deck is continuous from stem to taffrail, forming an exceedingly spacious promenade deck. The sides of the vessel are plated up to this deck forward of the paddle boxes, providing extensive shelter for second-saloon passengers in all weather. Abaft the paddle boxes the sides are open above the line of the main-deck bulwarks for the purpose of light and ventilation, which are special features of these vessels. The main deck at this part forms a sheltered and airy promenade for first-saloon passengers alongside the large central deck-house, and extending from amidships aft to the handsome smoking-saloon, which occupies the whole of the afterparts of the vessels, finished in hardwood, and fitted with spared seats of park form, tables, and revolving chairs. A refreshment bar is fitted in the smoking-room. Forward of the smoking-saloon a large deck-house is placed enclosing staircases to the main dining and ladies' saloons, and also containing a series of reserve state-rooms, fitted in a superior manner, for the use of passengers desiring to travel privately. The whole of the afterparts of the vessels on the lower deck are fitted up entirely for first-saloon passengers, with main saloon and ladies' saloon extending the full width of the vessels. Both apartments are large and commodious, and will be finished and upholstered in an elaborate style. Forward of the main saloon is arranged a separate dining saloon. It is intended on these vessels to keep the dining accommodation apart altogether from the general saloons, so that passengers when dining may not be inconvenienced by others who are suffering from *mal de mer* lying on the sofas in close proximity. The dining saloon extends the full width of the vessel, and will be finished in hardwood,

and fitted complete with sofas at sides, tables, revolving chairs, &c. The buffet in the centre of the dining saloon has a lift communicating with the receiving pantry on the main deck. The floors of the dining and smoking saloons are laid with teak parquet flooring. Select dining parties can be accommodated in two large rooms fitted for this purpose in the deck-house on main deck. Accommodation for second saloon passengers has been fitted in the forward part of the vessel. The second saloon, with large ladies' saloon attached, occupies the whole of the space below the main deck forward of the machinery. Particular attention has been devoted in providing for the comfort of those passengers who are not disposed to travel by the premier class, and the accommodation is much superior to the ordinary arrangements, which have previously been such a fruitful source of complaint. The second saloons are fitted up in a neat and substantial manner, having the sofas upholstered in carriage repp. Accommodation is arranged at forward part of main deck for the officers and crew. The captain's room, together with an office for the purser, are placed in a large deck-house on the promenade deck, with a bridge over same, from which the vessels will be navigated and steered. The vessels will be fitted with a set of compound diagonal and direct-acting engines, having two cylinders and surface condenser. The diameter of the high-pressure cylinder is 61 in., and the low pressure 112 in.—both being adapted for a stroke of 6 ft. 6 in. The high-pressure cylinder is placed above the low-pressure cylinder, and both are fitted with slide valves, which are used by the usual double eccentrics and link motion, and reversed by one of Messrs. Brown Brothers' steam and hydraulic reversing engines. The main working parts of the engines are made of steel, and the castings are also made of steel where practicable, for the purpose of combining strength with lightness. The paddle shafts, crank, and crank pins are made of Vickers' steel; the shafts and pins are made hollow, so as to reduce the weight. The water for condensing the steam will be circulated through the condenser by a centrifugal pump, driven by a separate engine. The paddle wheels have feathering floats, and, together with the paddle arms, feathering rods, &c., are made of steel. The engines are supplied with steam by four double-ended boilers 15 ft. diameter and 19 ft. 6 in. long, which are fitted with Fox's patent corrugated furnaces, the total number of furnaces being 24. The boilers are constructed of steel, and adapted for a working pressure of 110 lbs. per square inch. Fans and engines will be fitted in the stokehole, and arrangements made for supplying air to the furnaces. The vessels are provided with all the latest improvements for the comfort of passengers and for the safe working of the ship; being fitted with steam capstan windlass forward, steam capstan aft, steam and double-screw hand steering gears, &c. Special attention has been given to the life-saving appliances on board. Four large lifeboats will be carried, having patent detaching hooks; two of these boats will always be hung outboard in the davitts, ready for instant lowering; and several patent reversible-seat lifeboats will be carried on the promenade deck, ready for any emergency. Cork cushions forming life buoys will also be fitted to the deck seats along the bulwarks.

Meteor.—On April 7th Messrs. James & George Thomson launched from their yard at Clydebank a fine screw-steamer of the following dimensions:—Length, 260 ft.; breadth, 32 ft.; depth, 19·3 ft.; gross tonnage, 1,220 tons, and 3,000 H.P., for the London and Edinburgh Shipping Company, to be employed in their Leith and London service. The *Meteor*, as she was launched, was christened by Mrs. Aitken, wife of Mr. Aitken, jun. The ship is built of steel throughout, and is fitted up in the usual first-class style of the Company to which she belongs, and with engines supplied by Messrs. Thomson to accomplish the high speed required in this service. The *Meteor* is the seventh steamer built by Messrs. Thomson for the London and Edinburgh Shipping Company, under the management of Mr. Thomas Aitken. At the luncheon immediately afterwards, "Success to the ship" was proposed by Mr. J. R. Thomson, and replied to by Mr. Thomas Aitken. The health of the builders was proposed by Mr. Cowen, and replied to by Mr. G. P. Thomson. It is expected that the *Meteor* will be on her station early in May. This vessel is one of a type which carries passengers at a high rate of speed, and also serves the further mercantile purpose of cargo-carrying. These vessels, on account of their small size, minute subdivision, and high speed, would be of the greatest service in the time of war for patrolling the ocean highways.

Dotterel.—On April 8th Messrs. Ramage & Ferguson, of Leith, launched from their yard a handsomely modelled iron auxiliary steam yacht, named the *Dotterel*, built to the order of Mr. George Brook, of Huddersfield. The dimensions are:—Length, 113 ft., K. and F.; breadth moulded, 20 ft.; depth moulded, 13 ft.; tonnage, 215 Y.M. The rig is that of a fore-and-aft schooner, with Oregon pine lower masts, and fitted with topmasts. She is supplied with triple-expansion engines, with cylinders 9½, 15, and 24½ diameter and 18 in. stroke, with a steel boiler working up to 150 lbs. The *Dotterel*, which is intended to be stationed chiefly near the Island of Mull during the coming season, will be fitted up in a most luxurious manner.

Tantallon Castle.—On April 9th Messrs. S. & H. Morton launched from their shipbuilding yard at Leith a beautifully-modelled pleasure steamer, built to the order of Mr. M. P. Galloway, Leith. The steamer, which is 198 ft. long, 21 ft. broad, and 8½ ft. deep, has excellent cabin accommodation for passengers. The saloon is the full breadth of the ship, and the vessel having a raised quarter-deck, this has the effect of greatly improving the first-class dining-cabin below. There is another handsome dining-cabin situated under the fore-saloon. The steamer's engines, which are to be supplied by the builders, are of a diagonal surface-condensing type, having a single cylinder 45 in in diameter, with a 5 ft. 6 in. stroke, and will be supplied with steam from a vertical steel boiler of improved design. The working pressure will be about 70 lbs. per square inch. The steamer, which is to be placed on the Leith, Portobello, North Berwick, and Elie route, was named the *Tantallon Castle*, by Miss Croal, Craigcrook.

Thrace.—On April 9th Messrs. A. Macmillan & Sons launched from their dockyard, Dumbarton, the steel screw-steamer *Thrace*, sister to the *Ionia*, launched last month, and to the *Albania*, now building at the dockyard. These vessels are to form additions to the Greek Royal Mail and Passenger Steamship Line, trading throughout the coasts of Greece and adjacent seas, and are handsomely fitted up for a large number of first and second class passengers. They are to be finished with all modern improvements for comfort and economy, including the electric light. The machinery, which is of the triple-expansion type, of 1,700 I.H.P., is by Messrs. D. Rowan & Son, and capable of propelling the vessel at a speed of thirteen knots. The *Thrace* is of the following dimensions:—Length, 165 ft.; breadth, 34 ft.; depth, 21 ft.; tonnage gross register, about 1,500 tons.

Nouveau Reynard.—On April 11th the Grangemouth Dockyard Company launched from their shipbuilding yard a steel screw steamer of the following dimensions:—150 by 22 by 10 to main deck and 17 to saloon deck. Built under Lloyd's special survey for their 100 A1 class; the vessel will be fitted up with all the latest improvements and with large passenger accommodation, and is intended for the passenger and cargo trade on the coast of Hayti. The vessel, on taking the water, was named the *Nouveau Reynard* by Mrs. Peter Wilkie, Grangemouth. The machinery is being fitted on board by Messrs. Dunsmuir & Jackson, Glasgow. The vessel is a sister to the steamship *Nouveau Voldrogue*, launched recently by the Dockyard Company. Both vessels are being built to the order of W. E. Roberts & Co., Liverpool, for General B. Reviere.

Vigoureux.—On April 13th there was launched from the shipbuilding yard of Messrs. Lobnitz & Co., Renfrew, a screw steam tug, named the *Vigoureux*. The tug is for service at Port Said, and has been built to the order of the Suez Canal Company. Its dimensions are:—Length, 100 ft.; breadth, 18 ft.; and depth, 10 ft. The engines, constructed by Messrs. Lobnitz & Co., are to indicate 220 H.P., and the speed of the vessel will be 10½ knots per hour. There are two other tugs of the same dimensions on the stocks, and a fourth was launched the day previous.

Prince of Wales.—On April 14th the Fairfield Shipbuilding and Engineering Company, Limited, launched from their yard a large paddle steamer named the *Prince of Wales*, a sister ship to the *Queen Victoria*, launched by the Fairfield Company on the 29th March. These steamers are built for the Isle of Man, Liverpool, and Manchester Steamship Company, Limited, and are intended for their Manx Line, running between Liverpool and Isle of Man. The dimensions of the vessels are:- Length over all, 340 ft.; breadth, 39 ft.; depth, moulded to upper deck, 24 ft.; with a gross tonnage of 1,500 tons; and have been built under special survey of the Board of Trade. They have eight watertight bulkheads, seven of which are carried up to main deck. The watertight doors which are required between the engine and boiler spaces are fitted with self-closing arrangements, so that they can be closed instantaneously. All the fittings in the saloons, cabins, &c., are fitted in a most superior manner for the comfort of passengers. The vessels are being fitted with set of

compound diagonal and direct-acting engines, having two cylinders and condensers—high pressure cylinder 61 in., and the low pressure 112 in., with 6 ft. 6 in. stroke—the steam being supplied by four double-ended steam boilers. These steamers are being fitted with all the latest improvements for the safety of the ship and comfort of passengers, and are expected to be very fast steamers, on service the speed being equal to 24 miles per hour. Mrs. Barnwell, wife of one of the partners in the Fairfield Company, gracefully performed the ceremony of naming the vessel as she left the ways.

Bourlos.—On April 18th Messrs. Lobnitz & Co., Renfrew, launched a large twin-screw hopper barge, built to the order of the Suez Canal Company. She is named the *Bourlos*, and is 135 ft. long by 25 ft. broad by 11 ft. 6 in. deep, measuring 400 tons, and is propelled by two independent pairs of compound engines to indicate collectively 300 H.P. After being launched the *Bourlos* was taken to the builders' wet dock, where she will receive her machinery, also constructed by Messrs. Lobnitz & Co.

Caire.—On April 22nd Messrs. Lobnitz & Co. launched a large twin-screw hopper barge, built to the order of the Suez Canal Company. She is named the *Caire*, and is 135 ft. long by 25 ft. broad, by 11 ft. 6 in. deep, measuring 400 tons, and is propelled by two independent pairs of compound engines, to indicate collectively 300 H.P. After being launched the *Caire* was taken to the builders' wet dock, where she will receive her machinery, also constructed by Messrs. Lobnitz & Co.

Wood Cutter.—On April 23rd Messrs. D. & W. Henderson and Co., shipbuilders, Meadowside, Partick, launched a wooden cutter of 15 tons gross, 45 ft. long, 10 ft. broad, and about 7 ft. deep. She has been built for Mr. W. A. Coats, of Paisley.

LAUNCHES.—Irish.

Clandeboye.—On April 16th there was launched from the shipbuilding works of Messrs. Workman, Clark and Co., Belfast, a steamer built to the order of Messrs. Moore and Bros., the owners of the Bangor boats. The new vessel was christened *Clandeboye* by Miss Moore, after Lord Dufferin's seat in county Down, and in honour of the Governor-General of India. The word *Clandeboye*, it may be interesting to note, is derived from the Irish-Clann-Aedha-Buidhe (Clan-ay-boy), a tribe who, in the 14th century, possessed an extensive territory in the counties of Antrim and Down, which was the ancient "Clannaboy." The new steamer, which is two decked, is 225 ft. long, 25 ft. broad, and 8 ft. 9 in. deep. The main deck extends all fore and aft, and upon it is built a saloon house, with a promenade deck about 185 ft. in length. Two lifeboats are placed on the after sponsons, one on each side, and these are fitted with buoyant apparatus, so as to render them unsinkable. These boats are being fitted with Nelson's patent lowering and disengaging gear. Steam steering gear is also provided. The *Clandeboye* is a steel vessel, of very strong construction, and has been built to the requirements of the Board of Trade for cross-Channel purposes in the summer months. The engines, supplied by Hutson and Corbett, Glasgow, are to be of the double diagonal type, direct acting, with two upright boilers of steel. She will run in conjunction with the *Erin* and *Bangor Castle*.

LAUNCH—Austrian.

Stephanie.—On April 14th this new Austrian twin-screw ironclad was launched at San Rocco, near Trieste. She has a complete armour belt of 9 in., and one oval barbette with 8 in. of armour, carrying two 30½ centimetre Krupp guns. Abaft the barbette are six 15 centimetre Krupps, protected from machine-gun fire. The *Stephanie* has two masts with protected tops, and carries eleven light and six machine guns. Her displacement is 5,150 tons; length, 297 ft.; beam, 55·10; draught, 21½ ft. Her engines are of 6,500 H.P., and her estimated speed 15 knots. Her coal carrying capacity is 400 tons.

TRIAL TRIPS.

Montauk and Mincola.—On March 23rd the s.s. *Montauk*, built to the order of Messrs. T. Hogan and Sons, New York, U.S., and registered at Liverpool, by the noted shipbuilder, Mr. James Laing, Sunderland, went out to sea on her trial trip and afterwards proceeded on her voyage. She is a fine cargo steamer of 3,400 tons carrying capacity. Length, 284 ft.; breadth, 37 ft. 9 in.; depth of hold, 27 ft. 6 in. Built of steel to Board of Trade requirements, and classed 100 A at Lloyd's. She has a topgallant forecastle, with accommodation for sailors and firemen; long bridge, under which the officers' berths are placed; and long house aft, fitted up for passengers. The winches and donkey boiler are by Clark, Parson & Co., and has two winches fitted abreast main hatch; steering gear is the steam quartermaster by Higginson, of Liverpool, and hand gear by Hastie; the windlass is by Emerson and Walker, and is placed under the forecastle. There is also a fresh water condenser, 2,000 gals., fitted in galley (Kirkaldy's patent "Compactum"). The engines are by the well-known firm of Mr. George Clark Southwick Engine Works, Sunderland, and are of the triple-expansion type and fitted with all the latest improvements. Cylinders are 23, 38, and 62 in., with a stroke of 42 in.; boilers are of steel 14 ft. dia. by 11 ft. long, with a working pressure of 150 lbs. After several runs on the measured mile a mean speed of over 11 knots was obtained load ship, and I.H.P. of 1,300, the engines working perfectly cool without water on the bearings. A sister ship to the above for the same owners, named the *Mincola*, was launched on March 26th by the same builders. Both vessels have been built under the superintendence of Mr. Thos. A. Reed, consulting engineer, Jarrow-on-Tyne.

Thalatta.—On March 23rd the sea trial trip of the steam yacht *Thalatta*, built by Messrs. Philip & Son, of Dartmouth, for Frank C. Capel, Esq., of London, took place, the run being from Dartmouth to Cowes, a distance of 94 knots. This yacht is of teak, with oak frames, having a length of 90 ft., with a beam of 17 ft.; the run from Dartmouth to Cowes being covered in 9½ hours, in a heavy sea. It will be remembered that on the 23rd March the weather in the Channel was very boisterous, the Weymouth and Guernsey boat deeming it prudent to remain in harbour on that day, while sailing vessels were kept at their anchorages owing to the storm cone being up at all the stations on the south coast, and it says a good deal for the sea-going qualities of the *Thalatta* that the trip was performed in such good time, the engines never having been eased during the whole run, and while the passage was what would be called a lively one, the quantity of water that reached the deck was inconsiderable in such a sea. The engines of the *Thalatta* are by Messrs. Alex. Wilson & Co., of London, the cylinders being 15 and 27 in. diameter, by 16 in. stroke, indicating 180 H.P., and are fitted with Paynton & Wilson's patent circular-balanced and double-ported slide valves. These valves are meeting with a great success, and as Messrs. Wilson & Co. have been using them for the last six years they have now passed the experimental stage, and from their lightness as compared with piston valves, are worthy the attention of all marine engineers, and indeed of all those using steam at a high pressure.

Corsican.—On March 31st the screw steamer *Corsican*, built by Messrs. Workman, Clark & Co., Limited, of Belfast, and engined by Messrs. Hutson & Corbett, to the order of Messrs. Macfarlane, Oswald-street, Glasgow, went on her trial trip. The dimensions of the vessel are:—150 ft. long, 22 ft. broad, and 10 ft. 6 in. depth of hold, and the engines are triple-expansion, having cylinders 15 in., 24 in., and 40 in. diameter, by 30 in. stroke, supplied with steam from a steel boiler working on 155 lbs. pressure. The vessel is specially designed for general cargo and passenger trade, is classed 100 A1 Lloyd's special survey, and is certificated by the Board of Trade. On the measured mile a speed of 12½ knots per hour was obtained.

Esk.—On April 1st the hopper dredger *Esk*, recently launched by Messrs Simons & Co., Renfrew, built to the order of the Whitby Harbour Trustees, made its official trial. The trial took place at the Gareloch, with the result that a mean speed of a mile in excess of the specification was obtained. The dredging machinery was also tested, and also gave every satisfaction. Messrs. Hardy and Olliver, as representing the Whitby Harbour Trustees, and Mr. Brown and Captain Murray, were present at the trial.

Lizard.—On April 4th the *Lizard* was taken outside Plymouth Breakwater for a four hours' full-speed contractors' trial of her machinery with the natural draught. The result was as follows:—Draught of water forward, 9 ft. 7 in.; aft, 11 ft. 10 in.; pressure of steam in boilers, 124·5 lbs.; steam in cylinders—high, 45·9 lbs., intermediate, 16·7 lbs., low, 9·7 lbs.; revolutions of engines, 150·9; vacuum in condensers, 26·5 inches; I.H.P.—high, 226, intermediate, 203, low, 256—total 685; consumption of coal per I.H.P. per hour, 1·89 lb.; speed by patent log, 12·2 knots. During the four hours' trial the engines worked very satisfactorily, and without any hot bearings, and the boilers produced a good supply of steam without priming. The highest I.H.P.

attained was 737, which is 137 above the power contracted for. The *Lizard*, one of the *Rattler* class of gun-vessels, was built and engined by Messrs. Harland & Wolff, Belfast. She is a composite vessel with a protective steel deck, is 165 ft. long, 29 ft. beam, with a displacement of 670 tons. Her armament will consist of six 4-in. breechloading guns mounted on Vavasseur central-pivot carriages, two five-barrelled Nordenfeldts, and two 2-in. quick-firing guns. She is propelled by a screw of 9 ft. 6 in. diameter and 9 ft. pitch, driven by triple compound engines, and all the principal parts as well as the boilers are steel. During the trial the stopping and starting of the engines from full speed to stop was done in five seconds, from stop to full speed astern in eight seconds, and from full speed astern to full speed ahead in seven seconds. The result of the trial was highly satisfactory. The *Lizard* was again taken outside on April 6th for a four hours' full speed contractors' trial with forced draught. The result of the trial was:—Draught of water forward, 9 ft. 6 in.; aft, 11 ft. 7 in.; pressure of steam in the boilers; 140 lbs.; pressure of steam in the cylinders—high, 49·6 lbs., intermediate, 22·6 lbs.; low, 12·4 lbs.; vacuum in condenser, 26·75 in; revolutions of engines, 182·9; I.H.P.—high, 394, intermediate, 331, low, 300, total 1,025; speed by patent log, 13·5 knots; consumption of coal per H.P. per hour 2·12 lbs. The force of wind being 6, the speed of the vessel was very good. After being well clear of the land, it was found necessary to stop the ship to make some alterations in the pitch of the screw. After this, the *Lizard* proceeded on her four hours' trial without interruption, and made a minimum I.H.P. of 1,044, which is 44 over the power contracted for. Throughout the trial the engines worked very satisfactorily and without hot bearings, whilst the boilers gave a good supply of steam without priming.

Rhine.—On April 4th the trial trip of the tug *Rhine*, which was launched a fortnight ago by Messrs. David J. Dunlop & Co., Inch Works, Port Glasgow, took place. This vessel is intended for service on the river Thames in connection with the extensive dock system at Tilbury, and is the second tug built by Messrs. Dunlop for the London and Tilbury Lighterage Company, Limited, 50, Mark Lane, London, E.C. The *Rhine* is similar in construction and design to the *Danube*, and is of the following dimensions:—Length, 70 ft.; breadth, 16 ft.; depth of hold, 9 ft. 4 in. She has been built of steel under Lloyd's special survey for 100 A1 class, but on account of the exceptional strength required for dockwork on the Thames the *Rhine* has been specially strengthened about her bulwarks and topsides, whilst she is fitted with steam and hand steering gear and steam windlass. Triple-expansion engines have been supplied by the builders, the cylinders being 12 in., 18 in. and 30 in. diameter, by 22 in. length of stroke. After getting her compass adjusted the *Rhine* took on board at Princes Pier the following gentlemen: E. L. Hughes, Esq., managing director of Tilbury Company; W. L. Williams, Esq.; W. Dudgeon, Esq., surveyor for the company; Dr. Barr, Port Glasgow; David J. Dunlop, Esq.; James L. Dunlop, Esq.; A. C. Heron, Esq., Lloyd's engine surveyor, Greenock, &c. The trials for speed were made on the Gareloch, where highly satisfactory results were obtained, the speed being rather under 10 knots, whilst the engines exerted an indicated horse-power of about 350. The *Rhine* was then headed for a run down the Firth. After dinner the usual toasts were proposed and accepted, the company's representatives expressing themselves as being extremely well pleased with the performance of the *Rhine*.

Dogali.—On April 5th the royal Italian cruiser *Dogali*, recently built at Elswick by Sir W. G. Armstrong, Mitchell, & Co., Limited, from designs by Mr. W. H. White, the present Director of Naval Construction, was taken out of the Tyne for the official trial of her guns and machinery. During the forced draught trial of four hours she attained an average speed of 19·66 knots per hour, thus proving herself to be the fastest cruiser afloat. The engines were made by Messrs. R. & W. Hawthorn, of Newcastle-on-Tyne, and are twin-screw horizontal triple-expansion, having cylinders of 30 in., 45 in., and 73 in. in diameter and a stroke of 2 ft. 9 in. They have been specially designed to secure a large power on a small weight, and ran at an average speed of 153 revolutions per minute during the trial, developing upwards of 7,600 I.H.P.

Engeland.—On April 5th the paddle steamer *Engeland*, which was launched by the Fairfield Shipbuilding and Engineering Company (Limited) lately for the Zeeland Steamship Company, of Flushing, Holland, for a new daylight service between Flushing and Queenborough, ran her official trial at the Skelmorlie measured mile with results highly satisfactory to all concerned. The speed attained on the measured mile was 19¼ knots, with the engines working at 39 revolutions, being 2¼ knots in excess of the contract. The Zeeland Steamship Company were represented by the managing director, Z. van Woelderen, and the superintending engineer, A. van Rijn. The following are the principal dimensions:—Length, 286 ft.; breadth, 35 ft. 3 in.; depth moulded, 23 ft. 3 in.; gross tonnage, 1,700 tons. She is fitted with a set of compound oscillating engines, with surface condensers. High pressure, 60 in.; low pressure, 104 ft. dia., by 7 in. stroke; the steam being supplied by four cylindrical tubular boilers, single ended, of steel. She has been constructed with all the latest improvements to meet the requirements of Lloyd's special survey for Channel service. The accommodation throughout the vessel is of the most luxurious description for the comfort of the passengers.

Rajapuri.—On April 5th the *Rajapuri* (s) went her trial trip on the Firth of Forth. This vessel has been built by the Grangemouth Dockyard Company, to the order of Messrs. Dunsmuir and Jackson, engineers, Govan, for the Bombay Steam Navigation Company. The *Rajapuri* is fitted with electric light throughout, the self-housing arrangement for stowing her anchors up the hawsepipe under the patent held by Messrs. M'Nicoll & Co., Glasgow, steam windlass, and steam capstan. The machinery was supplied by Messrs. Dunsmuir & Jackson, and consists of triple-expansion engines, which developed 600 H.P.; large boiler, 160 lbs. working pressure, fitted with brass tubes and forced blast on Messrs. Howden's principle. The average speed attained on the trial was 12½ knots per hour.

Bramble.—On April 6th this composite gunboat was taken outside Plymouth for a four hours' full speed contractors' trial with the natural draught. The result of the trial was as follows: Draught of water forward, 9 ft. 7 in.; aft, 11 ft. 10 in.; steam in boilers, 120·9 lbs.; steam in cylinders—high, 43·1 lb.; intermediate, 14·9 lbs.; low, 9·4 lbs.; vacuum in condensers, 25·8 in.; revolutions of engines, 145·4; I.H.P.—high, 205, intermediate, 173, low, 242—total, 620; speed of ship by patent log, 11·7 knots. At the completion of the trial the engines were stopped from full speed ahead in seven seconds, full speed astern in eight seconds, and from full speed astern to full speed ahead in five seconds. The trial was in every way satisfactory. The vessel made her forced draught trial on April 7th, in the Channel. The following mean results were attained:—Draught of water, forward, 9 ft. 7 in.; aft, 11 ft. 10 in.; steam in boilers, 140 lbs.; vacuum in condensers, 26·4 in.; revolutions, 183·1; steam in cylinders—high, 47·3 lbs., intermediate, 23·7 lbs., and low, 12·8 lbs.; I.H.P.—high, 282, intermediate, 384, low, 413; speed by patent log, 13·4 knots per hour. The *Bramble* was constructed and engined by Messrs. Harland and Wolff, Belfast.

Forth.—On April 7th the official trial trip of the s.s. *Forth*, built by Messrs. A. & J. Inglis, Pointhouse, Glasgow, for the Carron Company, took place in the Firth of Clyde, and, notwithstanding somewhat disagreeable weather, was in every way a success. The advent of the *Forth* marks a new departure in the business of the Carron Company, and will, with a sister ship, the *Thames*, launched in January last, by the same builders, be an important addition to the increasing number of passenger and cargo steamers plying between the East of Scotland and London. Hitherto the company's steamers have been employed only in the carriage of cargo, but these two additions to the fleet will form the nucleus of the "Carron Line," and must greatly increase the trade and importance of the port of Grangemouth. The *Forth* is 230 ft. long, 31·2 ft. broad, and 14·35 ft. depth of hold, and has a gross tonnage of 869·50 tons. Her engines indicate 2,300 H.P. She has been fitted throughout—including the holds and cargo hatches—by the electric light by Messrs. Harvie & Co., Glasgow, the total number of lights in the vessel being 109; and she has been supplied with one of Sir William Thomson's compasses. In every way the vessel is excellently finished, and has been carefully built to suit every phase of the trade for which she is intended. A few days previous to the official trial she completed a series of speed trials, having made 36 runs on the measured mile, and finally a trip from the Cloch round Ailsa Craig, with a dead-weight cargo of 400 tons on board, 15·18 knots per hour. It is confidently expected that the vessel will make the passage between Grangemouth and London, or *vice-versa*, in 30 hours. At the official trial on April 7th the owners had a company of gentlemen on board, among whom were Mr. David Gowan, general manager, and several other officials of the Carron Company; Messrs. John Inglis, John Inglis, jun., &c. The ship was under the command of Captain Francis Carne. A smart passage was made down the Firth and round Holy Isle, off which the compasses were corrected. On the homeward journey dinner was served in the saloon. Mr. John Inglis presided, and Mr. David

Gowan acted as croupier. To the toast of "Success to the Carron Company," proposed by the chairman, Mr. Gowan replied, and said that the present movement was simply a resuscitation and improvement of a portion of their old system. The company had carried passengers to London in the days when they used to send up their carronades to the Thames. He proposed prosperity to Messrs. A. & J. Inglis, who, he said, had provided them with a capital steamer, and one in every way fitted for the trade intended. Mr. John Inglis, jun., briefly acknowledged the toast, stating that they had been successful in giving the ship one knot more of speed than was specified. The *Forth* sailed in the evening for London, and will take up the new route on the 3rd of May.

Orlando.—On April 13th this twin-screw steel-armoured cruiser, of 5,000 tons and 8,500 H.P., was taken outside Plymouth for a four hours' full speed trial with natural draught. Weights were placed on board the vessel to bring her down to her sea-going trim, and the result of the trial was: Steam in boilers, 127 lbs.; in cylinders, 37·8 and 38 lbs.; intermediate, 20·3 and 20·7 lbs.; low, 9·4 and 9·3 lbs.; vacuum in condensers, 26·2 in.; revolutions of engines (starboard), 104·4; port, 104·2; total I.H.P., 5,617. The highest power obtained during the trial was 5,856, or 366 in excess of that contracted for, and the mean speed, by patent log, was 17·2 knots. The vessel afterwards made a short run with the forced draught, as the result of which an I.H.P. of 8,200 was recorded, and a mean speed of 18·2 knots, but at one time during the run the speed ranged as high as 19·8 knots. The steering gear, which has been fitted by Muir & Son, of Glasgow, with improved tiller gear, the invention of Mr. Logan, Admiralty inspector, answered remarkably well, and the steering qualities of the vessel were regarded as good. A modern invention has been introduced and fitted to the after part of the ship, and in the conning tower, by which the officers can see at a glance the number of revolutions per minute the engines are making. This invention is the engine automatic direct tell-tale. Throughout the trials the engines worked satisfactorily.

Dayspring.—On April 14th the principal of the firm, Mr. J. F. Waddington, Mr. Weiss, of Liverpool, representing the owners, and a few friends started early in the forenoon with the *Dayspring* to run the trial trip on the measured mile outside the Mersey, and the day being fine a most enjoyable and highly satisfactory trial was made of the vessel's sea-going qualities and engine power. The guaranteed speed of 10 knots was easily attained, and thereafter the party proceeded down the river by way of Eastham ferry, Garston, and back to Liverpool, having had a continuous run of about six hours, at a minimum speed of from 8 to 10 knots; the party thereafter se arating, well pleased with the trip along the beautifully wooded shores of Cheshire and Lancashire.

Thames.—On April 15th the official trial of this steamer, owned by the Carron Company, took place. The mean speed was determined to be 15·33 knots per hour on an extended trial, the engines working throughout in a most satisfactory manner. The *Thames* is a sister vessel to the *Forth*, which was placed on the station between Grangemouth and London last month, and, like that vessel, was built by Messrs. A. & J. Inglis, Pointhouse.

Nouvelle Voldrogue.—On April 16th the screw steamer *Nouvelle Voldrogue*, lately launched by the Grangemouth Dockyard Company, went down the Firth of Forth on her official trial trip. On the measured mile a speed of 11·8 knots was obtained, being ·8 knots in excess of the guaranteed speed. The vessel is handsomely fitted up, and has large accommodation for passengers, and will shortly leave Grangemouth for Port au Prince to take up her station on the coast of Hayti. The Dockyard Company have at present two duplicate steamers on hand for the same owner. The machinery was supplied by Messrs. Dunsmuir & Jackson, Govan.

Yarmouth.—On April 16th the steel screw steamer *Yarmouth*, 1,432 tons, launched recently from the dockyard of Messrs. A. M'Millan and Son, Dumbarton, after undergoing progressive trials of speed, proceeded on her official trial. The vessel steamed to the measured mile at Skelmorlie, when she was subjected to a series of full speed runs, and accomplished fully the mean speed guaranteed by the builders of 14 knots, indicating about 2,400 H.P. The *Yarmouth* has been built to the order of the Hon. L. E. Baker, of Yarmouth, Nova Scotia, and is to be employed by the Yarmouth Steamship Company to carry passengers and mails between Yarmouth and Boston, U.S., a run across the Bay of Fundy of 16 hours, for which service the company receives a subsidy from the Dominion Government. She is built to the highest class at Lloyd's, and in accordance with regulations of our own and the Dominion and United States Board of Trade. This vessel is of a type rarely seen on the Clyde, having a beam of 35 ft. to a length of only 220 ft., with a steel house on deck, leaving a passage on each side, and extending almost fore and aft. This house contains, besides the main dining saloon, smoking-rooms, &c., cabins for passengers, and is surmounted by a range of teak houses, containing pilot-house and accommodation for captain, officers, and engineers. The number of berths on board is for 300 passengers. The machinery, which is on the triple-expansion type, by Messrs. D. Rowan and Son, worked most satisfactorily and smoothly.

Yeoman.—The screw steamer *Yeoman*, one of Mr. Lund's Australian liners, has lately made a capital run of 24 hours from the Tyne to London, where she takes her place on the berth to load general cargo and a party of emigrants for the colonies. The *Yeoman* was built about five years ago, but her owners determined to replace the compound engines originally fitted with a set of Messrs. Wigham, Richardson & Co.'s improved triplex expansion engines, working at 150 lbs. pressure. The new engines have cylinders 25, 38½, and 63 in. diameter respectively, by 44 in. stroke, and indicated 1,450 H.P. on the trial trip, which took place off the Tyne.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

BOARD OF TRADE CERTIFICATES.

To the Editor of The Marine Engineer.

Sir,—Allow me through your valuable paper to direct the attention of sea-going engineers to the following shameful injustice to engineers who have served their time to the trade. You will be surprised to learn the class of men who obtain from the hands of the Board of Trade certificates of competency as second and first engineers. Sir, you are aware by the Board of Trade regulations that pleasure yachts do not require certificated officers of any grade. I do not complain of that; consequently any one goes engineer, or rather driver of a steam pleasure yacht. Now this is what I complain of: these engine drivers put in four years sea service in these pleasure steam yachts and the Board of Trade acknowledges this service and allows them to obtain a second class certificate of competency, after twelve months more of such service (foreign) to pass for first engineer. I may say that out of the before mentioned four years at the very least three years are spent in harbour. Now this is a matter that should be taken up immediately by sea-going engineers, and a petition sent to the Board of Trade to allow only men who have served their time in an engineer's shop and their sea time in the merchant service to obtain engineer certificates. I feel sure the Board of Trade would grant it if properly explained to them. I hope you, or some of your readers will take the matter in hand; I can assure you its doing an injury to our sea-going engineers. I am a chief engineer and been to sea for the past twelve years; now I have a situation on shore consequently I will answer any questions respecting what I have stated through your paper or the Secretary of the New Union of Marine Engineers, 91, Minories, London, who I have asked to take this matter up. Yours obediently,

W. F. O.

April 23rd, 1887.

POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—Having just returned from abroad, and procured those back numbers of your journal which I had not seen, I was—while perusing the November number—greatly amused with the remarks of your correspondent, Mr. Little. On his own confession he is "a spoiled and pampered sailor," and as such, in reviewing the situation, he displays an excess of assurance and ignorance,

at which I—who know his class too well—do not marvel, but simply smile. He talks about the discourtesy with which "the so-called deck staff" formerly treated the engineer. Now in the early days of steam navigation, masters and mates were seamen, and frequently utilized their seamanship, much to their credit and honour; for as another of your correspondents writes, "the marine steam engine was then regarded more in the light of an auxiliary propelling power." Clearly then the engineer of that day held a position of no great responsibility, and as no great things were expected of him, he probably deserved no more imposing title than Mr. Little is graciously pleased to bestow on him.

Does it not occur to Mr. Little that he at present occupies a position as inferior, and very similar, to the one he accords the engineer of the early days of propulsion by steam? Can he not see that the responsibility and position of the deck staff have become and will continue to grow less and less, since "steam is *now* the *only* propelling power"? As an engineer, and one in the service of a steam navigation company second to none in point of importance, influence, and wealth, I view with becoming pride, the qualifications and attainments of my brother engineer officers. Still, when I compare their services with those performed by the deck staff, I must confess to feeling dissatisfied with our position, and I long for the advent of that desirable day, which shall bring about "the survival of the fittest," and culminate with the extinction of "the spoiled and pampered sailor."

Mr. Little's account of his miserable ship-board squabbles, resulting from his too intimate relationship with the donkeyman, scarcely bears on the question, but is certainly an amusing divergence from it. The entire duties of engineers and mates are vaguely described by him thus:—"*The engineer must maintain his speed; the mate must keep his watch without mishap.*" Is not this deliciously novel and refreshing information? Permit me to inform Mr Little that the maintenance of speed, though a highly important matter, is really the lightest of an engineer's duties and responsibilities; and if he (Mr. Little) belongs to a large modern steamship he will do well and wisely "to take observations" aboard the noble s.s. *Buccanneer*, before airing such mistaken ideas. If "seamanship be now (thank goodness!) a gradually vanishing quality," and likely to soon vanish altogether, and if the modern steamship should be still further improved upon and made by engineers independent, when afloat, of any aid from seamen or seamanship, what on earth is to become of Mr. Little and his *confrères*; and how will they ever reconcile themselves to a position in which they, unlike "the little boy," will not be seen, much less heard?

Mr. Little assures us "that there is no reason why an engineer should not LEARN 'so' much *arithmetic*, as is necessary to get a master's certificate; of course navigation is another matter which the Board of Trade 'don't' appear to require." Since the knowledge of a little arithmetic—navigation not being required, and seamanship being a gradually vanishing quantity—is about the only qualification wanted to ensure a successful application for a master's certificate, I am not surprised at Mr. Little adding "the officer of the future will be an engineer officer." I wish to distinctly affirm that "the officer of the present" is the engineer, and that the recognition of his undoubted claims to this position of priority is here sought for. The remainder of Mr. Little's letter being devoted to much homely advice and tiresome reiteration of matter of little moment and less interest, I need encroach no further on your valuable space. Yours obediently,

"VERITAS."

30th March, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—Allow me to thank the "Honorary Chief Secretary" of Marine Engineer's Union for his courteous acknowledgment of my few suggestions. But if he will allow me to say so, I think with the Editor, that it is a pity that the word "Union" should have been adopted—"a rose by any other name would smell as sweet"—and it is not always politic to call a spade a spade. I think it vastly creditable to our *esprit du corps*, that the onerous duties of the executive should have been undertaken honorarily; but I am afraid the duties of management will entail so much labour, if the idea be taken up so generally as I sincerely trust it may, that this arrangement will be found in time inadequate.

With regard to the vituperative letter of an "Uneducated Engineer" it is only another instance, if one were needed, that some people will not have the naked truth at any price. Its appearance on the *First of April* must be something more than a mere coincidence. The writer reminds one of Lord Palmerston's prize labourer, who had been a labourer all his life and never wanted to better his condition. If our friend really is, as he assures us, a constant reader of these columns, why then in good sooth, Mr. Editor, I fear me he will never do your teaching much credit. The Proverbs says "answer a fool according to his folly"; but then censure from some quarters is equivalent to *highest praise*. Does not our enraged friend know that unless the disease be properly diagnosed, it is impossible to apply the remedy for relief? He is so intensely "practical" that he scoffs and fumes at the very mention of theory; but such intense "practicality" when duly weighed, is generally found to amount to "impracticability." Rule of thumb and hammer and chisel may be all that is requisite to satisfy our friend; but he will find few supporters in these days of science and art classes and technical education schemes. Whatever my aspirations may be anent civil engineering, our friend will never be suspected of being a very *civil* engineer. And allow me to tell him I am perfectly well aware that editorship of a journal entails heavy and responsible duties; but these duties are not all equally heavy. It is a fair inference to draw that they are heavier on a weekly than a monthly journal of the same class. Yet if our friend will turn to the "English Mechanic" or the "Mechanical World" for instance, he will see vast quantities of information, on all branches of mechanical science, given weekly, and mostly by subscribers too. If our "uneducated" friend will condescend to turn to the "Engineer" for February 11th, 1876, he will find, despite his impotent anger at my suggestions anent inorganic chemistry, &c., this and many other sciences proposed (on good authority Mr. Michael Reynolds and the Editor), for certificated locomotive engine drivers; and he will see also "why" they are proposed. Does our canny friend's phenomenal humility brook this? Peace! perturbed Northumbrian, Peace!

Yours truly,

EXCELSIOR.

To the Editor of THE MARINE ENGINEER.

MR. EDITOR,—There can be no doubt in the mind of any certificated marine engineer our profession is sadly wanting in "touch," and there is no doubt we get no help whatever from the Board of Trade in return for fees we pay and the proof of education and competency the Board of Trade exact of us. "Foreigners" are allowed to present themselves and obtain certificates which should exclusively be the right of "the British subjects." It is well known that "Norsemen, Germans, and Hollanders" are holders of certificates which in the event of members of the Marine Engineers' Union taking a decisive action these foreigners will be brought in and defeat it. This should be the first step to take, "No foreigners entitled to certificates." The Trinity House Pilots have at last opened their eyes to this fact, and are now taking action to prevent foreigners poaching on their profession. The Governments of Holland, Belgium, Germany, Norway, Sweden and Denmark, are jointly protesting against the proposed exclusion, full well knowing how much their subjects gain to the loss of the British subjects, whilst each of these foreign Governments exclude British subjects from holding certificates entitling them to take charge of ships or engines under their respective flags. No engineer should have charge of a watch in engine room unless certificated. It has been my experience on board big ocean liners, carrying four seniors and four juniors, to find the third and fourth without certificates, but enjoying the pay of certificated engineers, and when I was in charge as second of steamers in home trade under 100 H.P. I had no certificate myself. This is an injustice to the certificated man, and one to which the attention of the Marine Engineers' Union should be turned forthwith. An examination and certificate prior to any junior engineer being allowed to sign on ship's articles is a vital necessity, and a third and fourth certificate should be made imperative in the interest of shipowners, and the interest of the Marine Engineers' Union. To put these matters into shape and into form, conveying their importance, we must obtain some patronage which will not only get force with "the powers that be," but stand by us permanently, and two or three big guns must be enlisted. Lord Brassey is a certificated engineer of the Board of Trade, and coming from a mechanical family should be interviewed. Should he see our object practical and not theoretical he would doubtless, having held office as Junior Lord of Admiralty, help us materially, and he might bring in one or two others. Admitting the certificated marine engineer should be efficient in reading, writing, arithme-

tic, and began in forges, finishing in boilers, engine shops, and valves, then upon finding in practice of our profession his deficiency in advanced education, its loss will give him ambition to, and he will read and acquire it. I graduated at College Notre Dame, and then began welding, &c., in forges, &c. Inorganic chemistry, hydrostatics, hydrodynamics, &c., as suggested in March number of MARINE ENGINEER by "Excelsior" will never make a marine engineer, although it is a superficial finish. Nor will such sciences ever teach him how to put a patch on a boiler in a gale of wind in the Bay or mid-Atlantic, help a breakdown at sea, or give him judgment in building fires to get steam with economy. Without expecting every engineer officer to be competent to hold his own, as some of us modern engineers can, in Continental languages, yet I cannot help thinking that would be more practically useful than the superficial suggestions of "Excelsior," for he certainly should be able (in the interest of our profession as a body) to exact from others an equal respect, by social demeanour, as an officer with the best of deck officers, but unhappily there are many, whilst in practice competent, in education and social demeanour deficient, and give me these men to work with when anything serious goes wrong at sea to one of the "toothpick-kidglove-excelsiors" who have passed and become certificated with little other merit or knowledge than shallow hypothesis. Association will do much to rub out deficiences. Men find out their own weight sooner by meeting and action, than writing. As a body, undoubtedly we are the coming profession, and being amphibious, funkers will never enter. But our greatest weakness is want of combination and knowledge of one another, hence want of "touch."

I am, Sir, yours truly,
RICHARD A. JAMES COPE,
Working Marine Engineer, No. 20517,
Decorated Order of Leopold, 2nd Class.
SAS-LES-OSTENDE (Belgium), *April 18th*, 1887.

THE MARINE ENGINEERS' UNION.

To the Editor of the MARINE ENGINEER.

SIR,—I am directed to forward you enclosed excerpt from minutes of meeting of the Executive Committee on 6th March, at which a unanimous vote of thanks was awarded you, and to respectfully request that you will accept the same as an official recognition by them of the value of the services rendered by you in the formation of the Union.

The letter of "An Uneducated Engineer" in your last issue, dealing with several matters that are of general interest to engineers, if you will kindly permit me, I will endeavour to reply briefly to some of his remarks. He certainly deserves credit for expressing his sentiments so fearlessly, and we cannot but endorse the truth of his main argument, but I think he might have let "Excelsior" down a little more easily. I have no idea who "Excelsior" is, but cannot believe he meant to cast a slur upon those of his brethren who may have been less fortunate than himself in the matter of education; my own impression being that he only desired to see the standard of examinations *gradually* raised until all engineers would eventually have at least a superficial knowledge of the subjects he names, and this is certainly commendable in view of the rapid progress that is being made in the development of the marine engine, and the additional burden imposed thereby upon the marine engineer but, as "A. U. E." forcibly points out, we must not overlook the fact that a *practical* knowledge of our work is the *first* and *greatest* essential. There is no doubt that scientific knowledge is a valuable acquisition, and easily carried about, and I am certain that even "A. U. E." himself will admit that if, in addition to the practical knowledge he now possesses, he were to learn something of the principles upon which the action of the steam engine depends, it would not make him less efficient as a practical engineer than he now is, but such knowledge may be gained at too great a sacrifice, as we have already seen, and that must be guarded against with the most zealous care. It is the opinion of those who are well able to judge of the cause of this widespread evil, that it is the system of training that is at fault and not the young men themselves, and it may be satisfactory to "A. U. E." to learn that it will be one of the cares of the executive of the Union to bring about, by legislation or otherwise, such changes in that system as will make it no longer possible to thrust into our ranks a number of young men, whose french-polished manners and general effeminacy might make them useful assistants to some enterprising linen-draper, but whose presence in an engine-room constitutes an additional element of danger, and who imposes upon his mates who are practical engineers an unjust and unwelcome burden. No doubt "A. U. E." will have seen by this time, if he has read your last issue, that our Union has met his views in the direction he has named, and it may interest him and many others to learn that every day brings me letters from all parts, containing enquiries for particulars, offers of assistance, and applications for admission as members, thereby showing that the Union is daily growing into favour, and that its becoming a large and powerful organization is only a question of time. It being obviously impracticable to open fully-equipped club houses simultaneously in about a score of sea ports, it may be mentioned that they will be opened one by one as the number of members and increase of funds permit, but it has been arranged to open branches in temporary premises in the meantime, where members may at once reap all the advantages offered by the Union, except those relating to the refreshment and lodging of members, and it will be seen by reference to the advertising columns that the addresses are there given of several that have been already opened, and I may add that in next month's issue will be found the addresses of several more. This, I trust, may show engineers that the Union possesses an active and enterprising executive, who are prepared to take prompt and decisive action whenever such may be necessary, and as the only reward they expect is that their brethren may express approval of their exertions by supporting the movement as it deserves, it remains now for engineers to say whether they are to submit any longer to injustice and oppression, or to embrace the present opportunity of emancipating themselves for ever by joining the ranks of the Marine Engineers' Union. Thanking you, Sir, for your kindness.

I remain, yours very truly,
THE HONORARY CHIEF SECRETARY,
Marine Engineers Union.
91, MINORIES, LONDON, *16th April*, 1887.

ENGINES AND BOILERS.

To the Editor of THE MARINE ENGINEER.

SIR,—However long and loud we may have laughed at some of the old theories held by former philosophers and their crude ideas of natural laws, there are still some lessons to be learnt from them, the least of which may, perhaps, prevent us from becoming too dogmatic in some of our opinions.

Until Torricelli—who was a pupil of the great Galileo—discovered the pressure of the atmosphere, it was enough to satisfy the minds of the then philosophers to say that "nature abhorred a vacuum." And this was, and is still, true, but Torricelli showed why nature had this abhorrence.

Now, with our advanced knowledge—in some things—we may truly say that nature abhors all things which disturb her equilibrium, and the more we deviate in either direction from that equilibrium the more strenuous are nature's efforts to regain it. And all our study of mechanical science may be said to be how to cheat nature into being our slave. But, however clever the best may be in thus cheating nature, it cannot be done without some expense and a loss, or failure in obtaining the full results. Let us look at this question in whatever light we may, this loss or failure will be found, and the results resolve themselves into a simple equation of profit and loss.

If we take the horse as a machine—one of nature's own productions—we can only obtain a percentage of power in return for the food consumed, and experience has taught the users of these machines that there is no economy in trying to obtain more than this percentage. Then neither the lightest nor the heaviest machine can be made to work without friction, and although it may be reduced to a minimum all our combined thought and study have not been able to overcome it.

In every age the philosophers laugh at those of the preceding age—with a few exceptions—just as the philosophers of to-day may in their turn expect to be laughed at, and perhaps in nothing will they be more deserving of this than in the use, or abuse, of the steam engine and boiler, more especially the latter.

Great advances have been made of late years in alterations in the steam engine. In the time of the writer the pressure of steam in marine boilers has gone up from 12 lbs. per square inch to 150 lbs. and higher, and the number of cylinders from one to three, and in some instances to four, through which to expand the steam. Whether these alterations are in the best or in the most scientific direction is perhaps a question worthy of discussion, or, to put it in other words, Have other feasible improvements kept pace with the increase of steam pressure and the number of cylinders? So far as the boilers and the mode of using them are concerned it can hardly be said that they have. And these increased pressures

and their equivalent high temperatures must tell, sooner or later, upon them with most disastrous results.

Take for instance the great number of inventions that have been made to heat the feed-water before it enters the boiler, few or none of which equalise the temperature of the feed-water with that in the boiler before it is forced into the boiler, which causes a continual contraction and expansion of some part or other of the plates. But what is this contraction and expansion compared with that which must take place in the furnace tubes, the tube plates, and all parts exposed to the lower temperature of the full blast of air admitted each time the furnace doors are opened? If anyone thinks for a minute what effect this must have they can hardly help being astounded and be compelled to come to the conclusion that, in a mechanical sense, it is a most barbarous way of treating a boiler.

It is generally known to engineers that radiation of heat—upon which consideration for your valuable space prevents my enlarging in this letter—increases in an ever-increasing ratio in relation to the increase of temperature, and that heat passes through iron with very little obstruction; but when a sudden lowering of the temperature on one side of the plates takes place, such as when the furnace doors are opened, and there is a high temperature on the other side, the plates are contracted more on one side than on the other, and the consequence is that the fibre of the material—let it be of iron or steel—is either strained or ruptured at once. But neither kind of material can bear this constant strain without becoming ruptured in time, and we should be led to think that this effect would be most likely to take place on small surfaces, such as the tube plates and the corrugations of the furnace plates, and with steel plates more than with iron. It may be truly said that all metals are more or less changed by heat, and the tests made for tension, torsion and crushing, when the material is in its normal condition just after being manufactured, or before it has been subjected to a constantly high temperature, would be very different after. This may be accounted for by reason of the particles or molecules being driven further apart. This does not take place in a short space of time, but by being constantly subject to a high temperature, the particles become fixed in accordance with that temperature, first on the surface exposed and gradually permeating until the whole of them become fixed.

Now, Sir, with our advanced knowledge of many things, it is generally sufficient to call the attention of our inventors to any great want to bring the man to the front with the remedy. Some years since there was a great want of something to prevent the deterioration of marine boilers through "pitting" or oxidation, and a *partial* remedy was found in the application of zinc plates, and one of your correspondents, in last February's number of THE MARINE ENGINEER, claims to be the inventor. Several of your subscribers are looking forward with some interest for his promised "statement" on this subject, more especially to see if he acknowledges the person who suggested to him the use of zinc plates. Not that it matters much, for that mind which reached to the use of zinc plates, will, by following the same train of thought, no doubt be able, if not entirely, to supersede zinc, to make it ten times more durable—that *twenty-nine shillings!* Government Report—and your correspondent—notwithstanding.

Yours respectfully.
PROPELLER.

Reviews.

On the Conversion of Heat into Work: a Practical Handbook on Heat Engines. By William Anderson, M.Inst. C.E. London: Whittaker & Co.

THIS forms one of a new and admirable series of handbooks which Messrs. Whittaker are at present engaged in bringing out, under the title of "The Specialists' Series," for the use of Students and Practical Engineers. The author states in his preface that a course of lectures delivered at the invitation of the Council of the Society of Arts in 1884-85 forms the foundation upon which he has built up his book. The object of these lectures was to aid in popularising the doctrine that in heat engines the work given out is due to the conversion of the molecular motion of heat into the visible motion which it was desired to produce; and, further, to illustrate, by numerous practical examples, the applicability of the doctrine of Sadi Carnot to defining the limits within which improvement in the economical working of heat engines was possible. Upon such a foundation, it goes without saying, a most valuable book could be built up, and the author, in adopting the method of working out his investigations by means of numerical examples, and comparing the results with those obtained in actual practice, has still further enhanced its value. The work is divided into seven clearly and concisely written chapters, the first dealing with the nature of heat, laws of motion, work, horse power, energy, &c., while Chapter II. treats of oscillatory motion and kindred subjects, the constitution of matter, including gases, specific and latent heat, absolute temperature, &c. Chapter III. is given up to the properties of gases, laws of expansion, expansion of steam, and the fundamental laws of thermodynamics. There is a statement in this chapter, namely, on page 77, that "In case of a gas, such as steam, near its point of condensation the adiabatic curve cannot be followed," which, having Zeuner's equation for the adiabatic line of a mixture of vapour and liquid before us, we can only attribute to an oversight on the part of the author. According to Zeuner, and assuming the condition of the steam at any point of its expansion to be known, including the proportion of water with it, its condition at any other point may be easily found by the following equation:—

$$\frac{x\,r}{T} + \int \frac{d\,q}{T} = \text{constant.}$$

Where x is the proportion of pure saturated vapour in the mixture, r the total heat of evaporation for 1 lb., and q the heat required to raise 1 lb. of the liquid to the temperature T, Zeuner, in his work, tabulated the value of $\int \frac{d\,q}{T}$ for steam of various temperatures, and with these tables and the above formula the actual specific volume of the steam and water can be readily found. Chapter IV. brings under our notice the laws of Carnot, the researches of Favre and Silbermann, sources of heat, mechanical aspect of combustion, various kinds of fuels and their heating value, regenerative furnaces, liquid and gaseous fuels, &c. These four chapters are occupied with what may be termed the theoretical portion of the work, while the three remaining chapters, which deal chiefly with the practical applications of the previously explained principles, need no enumeration here. The book throughout is copiously illustrated, but we should have been better pleased if some of the illustrations had not been so much reduced, as in cases there is a difficulty in tracing the lines.

Engineers' and Indicator Diagram Scales.

WE have received from Mr. John Lockie, of the Nautical Academy, 2, Custom House Chambers, Leith, a very neat and compact set of scales, designed for the use of engineers, and enclosed in a pocket case. The scales, six in all, are carefully printed upon an enamelled and grease-proof paper, and from their portability and cheapness should find a place in every engineer's outfit. The engineers' scales range from ⅛ of an inch to the foot to 4 in. to the foot, and includes a scale of chords, while the indicator diagram scales range from 8 lbs. to 40 lbs. to one inch. We are pleased to see that Mr. Lockie still continues to act as a successful "coach," and the names of the engineers who have passed under his tuition make of themselves quite a formidable array.

Hints to Sea-going Engineers, and How to Repair and Avoid "Break-downs." By W. H. Thorn and "E. S. B." Sunderland: Thos. Reed & Co.

THIS most useful little book (published, by the way, at the very moderate price of 2s.) has the great advantage of having been written by practical men, who have produced it with the desire to give an embryo marine engineer some idea of what his duties are, and how much he will be expected to do or not to do, rather than to expound any pet theories of their own. That such a book has long been wanted will, we are convinced, be almost universally acknowledged, and in their highly successful endeavours to supply the want, Mr. Thorn and "E. S. B." have rendered the profession a signal service, which, we trust, will meet with the hearty recognition that it so well merits. The authors have gone thoroughly into the whole subject, and conduct the apprentice just leaving the factory along the broad lines of the work expected from him in his daily round, while at the same time imparting to him a vast fund of information as to procedure at sea, &c. Any observant reader will come across many "hints" which will clearly show the intending second or chief some of the main points he will encounter in the efficient discharge of his ordinary duties. In addition to the very useful information given to the tyro, the book contains much solid information on that most fruitful head of

danger, a "breakdown" at sea. The latter part of the book is devoted exclusively to "breakdowns;" and after careful reading we should think that nothing that can happen in the engine-room is here left unprovided for, and, as stated in the final lines of the book, "to be forewarned is to be forearmed," we would strongly recommend the careful perusal of this part of the book, not only to the novice but also to those in charge of engines generally. The book is of a handy size, serviceably bound, and printed in a good bold type. Authors and publishers are alike to be congratulated on producing such a book at so moderate a price, and one that will so well repay all engineers for its perusal.

Key to Engines and Engine-running. By Joshua Rose. London: Sampson Low, Marston, Searle & Rivington.

The present work is arranged somewhat after the style of a catechism of the steam engine, and contains much that is both instructive and interesting, but it requires very careful reading as there are many pitfalls in it for the unwary reader. We have seldom, if ever, come across any technical book in which there are so many mistakes, which though trivial, are evident signs of carlessness on the part of the author. For instance, in giving the rule for finding the proper thickness of a cylinder, the author states "multiply the diameter of the cylinder" in inches, by the pressure of the steam in lbs. per square inch; divide the product by 4,000 and to the quotient add half. This is palpably absurd and has evidently never been worked out by the author, as by this rule the thickness of, say, a 10 in. cylinder, working at a pressure of 100 lbs. per square inch, would come out a considerable minus quantity. Under the heading "The known causes of priming," there is a mis-statement as to the ultimate temperature of the water in the boiler; this obviously should be 370 degrees, and not 270 degrees as stated. Again the word "suspension" is used instead of expansion," and in several cases the illustrations are referred to by wrong numbers, while in places wrong spelling has been overlooked; for instance resistance is spelt "risestance." The author's definition of a journal is not happily chosen, for he says: "A journal is a cylindrical part of shaft or rod, that acts as a piviot and supports another piece, and to guide its path of motion." This rendering is certainly very much at variance with our preconceived notions of the action of a pivot. Further on we are told that "the weight of a fly-wheel is equal to the continued product of the area of the piston in square inches; boiler pressure by guage in pounds; stroke of engine in feet; value for cut-off; co-efficient of fluctuation, and accelerated force of gravity, divided by the square of the velocity in feet per second of the centre gyration of the wheel." This in America may be considered a beautifully simple way of getting "the *weight* of a fly-wheel," but in England they are generally placed on a weigh-bridge and the result given in tons, cwts., and qrs. We, however, use a somewhat similar method for determining the stored energy of a wheel, and this is most likely what the author means.

In the way of paper, printing, and illustrations, the book leaves nothing to be desired, and with the exception of the faults referred to is well worth perusal.

Drawing and Rough Sketching for Marine Engineers. With Supplement. By James Donaldson. London: Charles Wilson.

In bringing out the fourth edition of this most useful work the author has availed himself of the opportunity not only to revise and bring down to date the earlier editions, but also to add a supplement on "Rough Working Drawing for First-class Engineers, with a List of Examination Subjects." In its present form the book should certainly be in the hands of all marine engineers, and more especially should it be carefully studied by those on the eve of their examinations, for nothing tells more in a man's favour, or is of more real service to him outside the examination room, than the power of making rapidly, neatly, and accurately, sketches of the different parts of engines and boilers, and their fittings, with all of which he is supposed to be thoroughly acquainted.

What may be called the first part of the work deals with a number of most interesting facts concerning drawing materials and instruments; the correct delineation of various engine details; together with rules for correctly proportioning each detail and many practical hints on special points to which attention should be paid. Boiler and engine designing, and instructions on the manufacture of propellers and paddle wheels, also form part of the work. These various subjects are fully and lucidly dealt with in a practical and concise manner, and are illustrated by means of 19 sheets of well executed drawings in which all details and full dimensions are given. In the supplement a full set of sample papers are given, such as are set in the examination in rough working drawing for a first-class engineer's certificate of competency, and these are also accompanied by 17 sheets of drawings, each done to scales. Besides these the supplement contains many useful tables and a series of short articles, each devoted to some important subject in connection with engines, pumps, and boilers.

The book throughout is written in that clear and lucid style which shows the author to have a thorough and practical knowledge of his subject, and Mr. Donaldson is to be congratulated for having adhered to the matter of fact details in every day use rather than making his work a learned treatise on practical geometry, projection, perspective, etc., which would have made it useful only to the specialist; as it is the book is one suited in every way to the requirements of practical men.

The book is of a handy size, while the printing is good and bold, the drawings are beautifully clear, and the binding is of a substantial character.

Adam's Patent Line Divider.

This expeditious method of dividing a line of any length into any number of equal parts consists essentially of a square having sides 12 inches long and divided by diagonal lines spaced one-twelfth of an inch apart at the top, and opening at to one-sixth of an inch at the bottom; consequently there are 144 divisions at the top of the square, and only 72 divisions at the bottom. Hence it follows that lines running from side to side and parallel to the top will intersect more or less of the diagonal lines according as it is nearer the top or bottom of the square.

The divider is printed on strong tracing cloth, and can either be laid over the line to be divided, the required divisions being then pricked through, or suitable paper scales can be plotted off from the divider. The diagonal lines are coloured in alternate groups of four, and any desired combination can thus be readily effected.

A small supplementary scale at the side of the larger one allows of divisions as fine as one-fortyeighth of an inch being made. The divider is mounted on small wooden rollers, and when folded is very compact. It is published by Mr. A. G. Dawson, of 14, Ivy Lane, Paternoster Row, E.C.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from January 17th to April 18th, 1887.

459 M. P. W. Boulton and E. Perrett. Producing motive power.
469 A. MacLaine. Feed water heating arrangements.
472 H. Lancaster and R. F. C. Tonge. Packing springs for pistons, etc.
488 H. Babington. Valves.
527 J. Vavasseur. Gun mounting.
534 D. Adamson. Flues and shells of boilers.
535 D. Adamson. Manufacture of flues and shells of boilers.
543 A. H. Sheppard. Signal valve and clearance cock for steam boilers.
554 J. McLean. Steering gear.
555 T. Leitch. Screw propellers.
560 W. Whittaker. Mechanical stokers for furnaces.
592 J. B. Stubbs. Steam traps.
598 J. G. Bonner and C. Dutton. Valves.
601 T. Taylor. Steam boilers.
612 Myall (A. Stenhouset H. Fenoulhet). Propelling of ships, submarine boats, etc.
659 A. Holt and J. T. Holt. Steam engines.
669 Zehren Frères. Tap or cock for water, steam, etc.
682 A. Moncrieff. Mounting guns.
694 Redfern (J. Rainchon). Vertical tubular boilers.
708 A. Harrison. Steam dredges.
730 G. Rolls. Converting certain marine.
731 P. Hanrez. Construction of ships.
800 J. B. Willis. Electric telegraph apparatus for communication between the bridge and engine-room of a ship.
887 J. Jones. Ventilating ships, &c.
895 W. Shelley. Ships' lanterns.
958 L. H. Phillips. Lifeboats and ships' boats.
963 A. H. Knight. Closing a hole or rent in a ships' side.

997 J. E. Reaney. Screw propellers.
1007 I. Charton and G. L. Scott. Ships' berths, &c.
1051 G. W. Green. Attachments or parts of oars, sculls, &c.
1089 Dansey (L. C. Auldjo). Condensing apparatus for ships' use.
1135 H. McC. Alexander. Iron ships.
1184 J. H. Lancaster. Grappling, digging, or dredging.
1226 M. H. Dement. Propelling vessels.
1244 H. N. Morgan. Torpedo.
1277 C. A. McEvoy. Testing and firing submarine and other mines.
1445 T. White. Making or rolling tapered slips for ship and other plate-work.
1453 T. S. Stevens. Controlling a ships' rudder.
1482 Allison (The Gas & Power Co.). Storing inflammable vapours in boats, to be propelled thereby.
1530 D. McGregor. Mariners' compass and binnacle.
1582 Boult (S. W. Merryman). Boiler cleaning compounds.
1584 J. C. Ricketson. Electric signals for engines.
1601 A. C. Trew. Stormwater and tidal valves.
1725 E. Lawson & H. Lea. Ships' berths.
1764 F. W. Richardson. Propelling ships, &c.
1766 J. Lepper & J. Pollock. Pistons for steam and other engines.
1787 G. Tyzack. Anchors.
1807 W. Shapton. Ships' cranes.
1815 Boult (V. Pagan). Anchors.
1842 M. Archer. Winches.
1843 A. C. Kirk. The supply of distilled water and utilization of heat in connection with marine boilers.
1850 T. Thorsen. Ships' bottom scraper.
1867 E. A. Goddin. Cleat for holding ships' ropes, &c.
1868 A. Brown. Dredging vessels.
1881 E. G. Wright. Water-stopper for ships' sides.
1884 N. Harrison. Readily finding the error or correction of the mariners' compass.
1892 J. Darling. Distilling sea water for use on ships.
1975 G. Beech. Paddle-wheels, screws, &c.
1990 Redfern (R. J. H. Saunders). Harbours, piers, &c.
2110 F. W. Brewster. Imparting buoyancy to lifeboats, &c.
2121 G. Taylor. Loading and discharging coal cargoes.
2188 W. Thomas. Loading and unloading vessels, &c.
2227 J. W. Shepherd. Collapsible ship or boat.
2285 C. W. Lees. Saving life at sea.
2296 G. W. Carter. Controlling sluice ways or outlets.
2310 J. T. Morris. Lifeboats, &c.
2333 S. Kilby & H. Mobbs. Boiler explosion preventer.
2387 E. J. Lloyd & W. Salt. Transferring ships, &c., from one level to another.
2406 T. A. Garrett & W. Lucas. Speed indicators.
2426 F. Reeves. Applying power to steam vessels.
2450 D. T. Fender. Hydraulic apparatus for dredging.
2461 J. Charlton & G. L. Scott. Ships' berths, &c.
2464 W. Clark. Causing projectiles to strike ships below water line.
2494 W. Andrew. Securing or stowing and releasing ships' boats.
2515 H. Kranz. Stopping and steering ships.
2516 Do. Launching torpedo-boats, &c.
2548 A. J. Sedley. Ship's screw propeller.
2556 F. B. Crowe. Centre boards for boats, &c.
2574 R. T. Baines. Stop cocks.
2582 A. Langdon. Screw propeller.
2584 A. B. Betts. Hydaulic cranes for ships.
2594 F. D. Taylor. Anchors.
2617 T. R. Oswald. Twin-screw vessels.
2639 J. Cosens. Rowlocks for boats.
2643 W. Rose. Ships' anchor.
2673 H. J. Carter & J. Aynsley. Emigrants' berth.
2715 S. Hart. Apparatus for steering and saving life at sea.
2761 W. Macgowan. Propulsion of vessels.
2864 R. D. Kay. Valves for inflating life-belts.
2951 E. Lawson & E. W. de Rusett. Ships' berths.
2977 J. Caudwell. Steam ferry raft.
2991 Lorrain (F. Finlayson & G. A. Gosselin). Marine governor.
3001 W. Mackie. Preventing the inflow of water into ships &c. after collision.
3058 F. Favarger. Protecting ships and harbours.
3117 C. Gannaway. Ships' ventilator.
3134 F. W. Cannon. Steam winches for vessels, &c.
3173 S. H. Nealy & Lee Hutchins. Marine torpedoes.
3213 S. C. Harris. Grab dredgers and excavators.
3224 Newton (E. Theisen). Condensing apparatus.
3230 Tangyes, Limited, & T. Jefferiss. Combined portable boiler and centrifugal pumping engine.
3236 Lake (F. C. Johnson). Booms for sailing yachts, &c.
3250 T. P. Wood. Improvements relating to sculls.
3266 W. M. Walters. Raising sunken ships.
3322 J. & E. & J. Ford. Anchors.
3420 N. Arthur. Rigging screw.
3427 C. J. Fox. Ships' berths.
3452 W. S. Chantrell. Lubricators.
3457 J. P. Wilson. Forced draught and combustion in marine steam boiler furnaces.
3480 W. Schermuly. Life buoy, &c.
3506 A. H. Farrow. Propelling apparatus for vessels.
3508 J. G. W. Aldridge. Life-saving seats for ships.
3527 Allen (Max Muret). Propelling boats, &c.
3580 J. S. Comrie. Torpedo indicating light gear.
3644 J. Cooper. Rotary pumps.
3667 F. Hocking. Producing fresh water from salt water.
3673 Newton (A. Nobel). Projectiles.
3674 Do. Do. Compensating for the recoil of guns.
3676 Do. Do. Detonators.
3687 S. A. Johnson. Ships' lamp, &c.
3706 T. R. Fox. Covers of hatchways.
3721 W. Leeglitz. Windlasses.
3733 A. Moncrieff. Mounting guns.
3737 D. Purves. Rotary valves.
3746 W. C. Storey & G. Poore. Supporting and feeding torpedoes.
3747 Do. Do. Submarine vessels.
3750 E. S. Copeman. Life-saving rafts for torpedo boats.
3771 J. J. Arnold. A tide trap.
3773 J. White. Sheet metal boats.
3788 R. E. Laird. Producing motive power.
3809 M. & T. H. Scarth. Screw propeller.
3823 G. A. Smith. Marine governors.
3846 F. R. Cox. Link motion.
3852 C. Griffin. Rotary engines.
3872 E. St. J. Christophers & E. Dunk. Explosive shells.
3921 J. P. Wilson. The stowing of ships' boats.
3948 H. P. Fenby. Corrugated flues and fire boxes for boilers.
3974 S. Liemang. Compound chilled casting for armour plates.
3989 P. Brotherhood. Three cylinder engines.
4096 P. Hubert. Steam engine differential lubricator.
4115 J. Rogerson & A. Downie. Rapid firing guns.
4123 H. B. Merton. Steam engine valve gear.
4148 A. H. Broadbent. Maintaining a constant plane in steamers.
4159 C. Stout. Fluid motor cylinders and pumps.
4205 D. S. Cresswell. Engine packing.
4206 Scholes & Whitehead. Water alarm for steam boilers.
4214 Alison (E. Lambinet). Engine speed indicator.
4227 G. Poore & W. C. Storey. Submarine boats.
4280 F. Casse. Inexp'osive steam boiler.
4320 H. S. Maxim. Guns.
4328 R. Knox. Propulsion of navigable vessels.
4336 P. W. Fritz. Pumping apparatus with hydraulic gear.
4343 T. Lambert. Rotary engines.
4423 J. R. Thomson & J. H. Biles. Boilers.
4429 Sir W. T. Lewis & C. L. Hunter. Facilitating the shipment of materials.
4455 D. N. Salmond. Preventing and removing incrustation in steam boilers.
4470 W. Tinmouth. Connecting ships with their anchors.
4476 S. Lloyd. Transferring boats from one level to another on canals.
4491 Redfern (A. Palfroy). Propeller.
4542 S. Taylor. Signalling audibly under water.
4552 W. H. Gales & H. J. Huthwaite. Anchors.
4554 W. Kieser. Assisting the direction of the firing of ordnance on ships, etc.
4589 J. R. Thomson. Promoting combustion in boiler furnaces in steamships.
4596 S. E. Turvey. Submarine vessels.
4602 J. Gilmour. Steam condensing and fresh water supplying apparatus for steamships.
4604 H. Middleton. Submarine boats.
4624 Newton (J. Merlette, senr.). Propulsion and steering of vessels.
4641 W. Holderness. Life vessel.
4661 T. W. Worsdell. Compound engines.
4673 J. H. Sharrock. Ship's watertight bulkheads.

4685 E. W. V. Duzen. Furnaces and grate bars.
4708 R. Fleming. Rudders.
4732 T. Dixon, junr. Boiler tube stopper.
4765 J. W. Shepherd. Deck seat for vessels, etc.
4778 H. S. Maxim. Automatic guns.
4796 R. Low. Gun for throwing lines.
4829 Dobie (J. G. Dobbie). Screw propeller bosses and their shafts.
4878 S. A. Johnson. Enabling a constant watch to be kept in respect of ships' lights.
4892 W. Fraser. Lubricator.
4897 E. S. Copeman. Life buoy.
4916 D. Cunningham. Dredging apparatus.
4918 J. Smith. Steam winch.
4958 J. Heslop. Automatic feedwater measurer for marine and other steam engines.
5017 Jensen (J. Welman). Dredging apparatus.
5055 C. Douglas. Boats' davits.
5059 J. Powell, R. S. Jordan & G. Golightly, junr. Haulage clips.
5117 A. Macpherson. Lowering and disengaging ships' boats.
5135 A. G. Brown. Compound or expansion engines.
5198 A. J. Marquand & S. Williams. Boiler tube cutters.
5207 A. Moncrieff & W. Anderson. Mounting and working disappearing guns.
5273 R. Montgomery. Triple, quadruple, and compound expansion engines.
5277 D. W. Porteous. Holding ships' rudders.
5289 P. Williams & W. Powles. Signalling on ships, etc.
5327 R. Willis. Speed indicators.
5374 J. W. Shepherd. Watertight doors.
5385 Haddon (W. H. Craig). Lubricators.
5441 W. D. Player & T. Instone. Removing incrustation, etc., from steam boilers.
5451 T. Nordenfeldt. Quick firing guns.
5469 A. Dickinson. Condensers.
5472 E. Stinton. Alignment of shaft bearings.
5478 D. A. Cormack. Protecting screw propellers from corrosion.
5538 W. J. Brewer. Torpedoes.
5551 W. Kennett. Boat disengaging hook.
5614 F. R. Francis. Indicating lights for ships.
5635 G. A. de Penning. Steam vessels.

BOARD OF TRADE EXAMINATIONS.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

Feb. 19th, 1887 (*continued*).

Mumford, Newmn 1C N. Shields
Noble, John .... 2C Liverpool
O'Flyn, Maurice . 2C N. Shields
Paterson, Andrew 2C Glasgow
Riddle, Andrew C. 1C London
Scott, Reginald N. 2C N. Shields
Smith, Wm. G... 2C Hull
Stewart, Robt. W. 2C W. Hartpl
Sweeting, John J. 2C ,,
Thomas, Philip.. 2C London
Thomson, Thos. T. 2C Liverpool
Turner, Wm. C. . 1C W. Hartpl
Tyson, Thomas... 1C London
Walker, Fred. .. 2C ,,
White, Daniel .. 2C Hull
Whyte, Matthew 2C Glasgow
Williams, Wm... 1C Liverpool
Williamson, V. A. 2C N. Shields
Wilson, John .. 1C Glasgow
Wright, Johnston 1C ,,
Yardley, R. W... 1C Liverpool

February 26th, 1887.

Atkins, Andrew . 2C Sunderl'd
Black, John J. .. 1C Sunderl'd
Chisholm, George 2C Liverpool
Copeland, A. Mill 2C Dundee
Davie, Albert O. 2C Sunderl'd
Drake, Fred W. . 1C London
Dunning, Wm. 2C Liverpool
Fife, George .. 2C Dundee
Fletcher, R. H. 2C Liverpool
Hodge, Robert . 2C Liverpool
Johnstone, W. A. 1C Dundee
Korner, J. H. .. 2C Sunderl'd
Lee, William .. 2C Sunderl'd
Mowat, James .. 2C Aberdeen
Pollitt, John T. 2C Liverpool
Ramsay, A. B... 2C Dundee
Sinclair, Russell 2C London
Taplin, John M. 1C Liverpool
Thomas, Edward 2C London
Thompson, Geo. 1C Dundee
Tolman, Fredk. . 2C Sunderl'd
Wellbury, J. .. 1C Sunderl'd

March 5th, 1887.

Baillie, John .. 2C Glasgow
Banks, Fred. W. 1C N. Shields
Beard, Richard 2C Liverpool
Brown, George 2C Leith
Brown, James .. 2C Glasgow
Burn, Thos. C. 2C N. Shields
Burns, Wm. M. 2C Greenock
Buttar, W. McE. 2C Leith
Donald, James .. 2C N. Shields
Dove, Richard .. 2C London
Duckitt, Jos. W. 2C Hull
Duncan, John .. 2C Greenock
Durham, John .. 2C Glasgow
Fallows, John .. 2C Liverpool
Farquharson, A... 1C Leith
Forsyth, John ... 2C Glasgow
Garner, Geo. Hy. 1C Bristol
Hains, Richd. C. 2C Liverpool
Harkess Wm. .. 2C Geenock
Harley, Jas. .. 2C Glasgow
Harper, Geo. .. 2C ,,
Harrison, Fred. . 1C Hull
Hastwell, Henry. 1C N. Shields
Headrick, John .. 2C Glasgow
Irving, Peter .. 2C ,,
Jackson, John .. 2C Hull
Law, Francis .. 1C Glasgow
Maclean, Wm. D. 1C ,,
McFarlane, Henry 1C Greenock
McGilchrist, T. B. 2C Leith
McQuarrie, A. .. 2C Liverpoo
Nisbet, Richd. M. 2C Glasgow
Ormiston, Robert 1C Leith
Pelton, Fred..... 2C N. Shields
Pullen, F. .. .. 2C London
Ramsay, John .. 2C Leith
Renfrew, Robt... 2C Glasgow
Ritchie, Alex. .. 1C Leith
Robson, George . 2C London
Sandeman, Alex. 1C Leith
Shuttlew'th, H. H. 2C London
Smail, David.... 2C Leith
Stewart, David H. 2C Liverpool
Swanson, George 2C Leith
Thomas, Robt. P. 2C Liverpool
Thomson, H. A. . 2C London
Walker, John .. 1C Glasgow
Whitehall, Wm. 2C ,,
Young, George.. 1C ,,

March 12th, 1887.

Appleton, Hy... 2C N. Shields
Banks, Geo. R. 2C London
Beal, Rich. .... 2C W. H'pool
Davison Geo. .. 2C ,,
Dickinson, W. G. 2C ,,
Donald, Robt. .. 1C Glasgow
Dunlop, Robt... 1C ,,
Fairbairn, A. F. 2C N. Shields
Fyfe, John .... 1C Glasgow
Gillespie, Andrew 2C ,,
Hall, Percioso .. 1C N. Shields
Hamilton, Alex. 1C Glasgow
Parker, John H. 2C W. H'pool
Parkinson. H. S. 2C London
Ramsay, Thos. H. 2C N. Shields
Rouse, John Thos. 1C London
Sharp, William 2C W. H'pool
Spoor, Wm. John 2C N. Shields
Stewart, Sam. T. 2C ,,
Todd, Robert .. 2C W. H'pool
Wallace, Wm... 1C Glasgow
Wilkinson, C. W. 2C N. Shields

March 19th, 1887.

Bibby, James .. 1C Liverpool
Davies, Griffith.. 1C Cardiff
Davies, John H.. 1C ,,
Denby, Percy .. 1C ,,
Dobson, Philip K. 1C Liverpool
Easthope, Jas. .. 1C Cardiff
Graham, Andrew 1C Dundee
Hannah, David.. 2C Liverpool
Harwood, John.. 1C N. Shields
Hill, Charles .... 2C Cardiff
Hind, Wm. .... 1C N. Shields
Howat, Andr. T. 2C Liverpool
Hughes, Wm. P. 2C Cardiff
Kilpatrick, J. K. 2C Dundee
Kirkpatrick, Rbt. 2C ,,
Lace, E......... 2C Cardiff
Lawson, Lawrence 2C Liverpool
Millard, John J. 1C Cardiff
Mills, James .... 2C Leith
Moody, Geo. F. H. 2C N. Shields
Owen, Jenkin .. 1C Cardiff
Shepherd, John G. 1C ,,
Thomas, Geo. .. 2C Cardiff
Torrance, John.. 1C N. Shields
Will, John...... 1C Dundee

March 26th, 1887.

Abolit, John Wm. 2C N. Shields
Barnes, Daniel .. 2C Sunderl'd
Bloxam, T. M. S. 2C London
Brown, James .. 1C Sunderl'd
Carpenter, Hy. A. 2C London
Gaston, David H. 2C ,,
Harrison, Jos. B. 2C Sunderl'd
Hewitt, Wm. B. 1C ,,
Hudson, Geo. W. 2C Hull
Hudson, John .. 2C Sunderl'd
Horan, Hy. .... 2C ,,
Kemp, Wm. .... 2C Liverpool
Laming, Hy. Jno. 1C London
Likiardopulos, N. H. 2C London
Lockyear, Frs. W. 2C Hull
Middleton, Jno. R. 1C N. Shields
Nicholson, Geo. A. 2C Sunderl'd
Northall, Joe .. 2C N. Shields
Poole, Wm. .... 1C London
Probert, Joseph.. 2C Sunderl'd
Prowse, Peter.... 2C Liverpool
Richardson, Ralph 2C Sunderl'd
Sinclair, Jas. G... 2C ,,
Walker, David .. 1C ,,

April 2nd, 1887.

Boahier, Herbt. F. 1C London
Bowden, J. A. .. 1C ,,
Chipchase, A. D. 2C N. Shields
Clark, James R. 1C London
Collings, R. B. S. 1C Liverpool
Dalgarno, Wm... 1C ,,
Dick, Archibald.. 2C ,,
Edwards, Jas. W. 2C ,,
Gotts, John .... 2C N. Shields
Hake, George A. 1C London
Hall, John...... 1C Aberdeen
Hudson, John H. 2C Liverpool
Macpherson, Peter 2C Glasgow
McIntyre, Daniel 1C ,,
Mercer, James .. 2C Liverpool
Mitchell, John .. 1C London
Paterson, John .. 1C Aberbeen
Queen, Walter .. 1C Glasgow
Reed, Samuel .. 2C Liverpool
Reid, Wm. .... 2C Glasgow
Riddell, Robert.. 1C London
Rogan, Alfred J. 2C ,,
Scott, Thos. .... 1C Glasgow
Smith, Robert A. 2C London
Sumner, Norb. S. 2C Liverpool
Stokes, William.. 2C London
Tammit, John F. 2C ,,
Taylor, James W. 1C Liverpool
Troup, Charles L. 2C London
Webster, Harry B. 2C Glasgow
Wood, Jas. .... 2C Glasgow
Wright, John .. 2C ,,
Wylie Wm. T. .. 2C ,,
Yule, Alex. A. .. 1C Aberdeen

April 9th, 1887.

Aitken, John K. 2C London
Blackwood, Wm. 2C Greenock
Dowie, Robert C. 2C Liverpool
Fernie, John.... 2C Greenock
Flower, Charles A. 2C ,,
Gibson, James .. 1C N. Shields
Griffiths, Lewis.. 1C Liverpool
Hobson, Alf. W. 1C ,,
Mawdsley, W. C. 1C ,,
McFarlane, W. C. 2C N. Shields
Milburn, Joseph 1C ,,
Renton, Wm. .. 2C ,,
Roberts, John .. 2C Liverpool
Thompson, John 2C Greenock
Waring, William 1C Liverpool
Wilson, Thos. T. 2C N. Shields

The Marine Engineer.

LONDON, JUNE 1, 1887.

EDITORIAL NOTES.

THE Thames Ironworks and Shipbuilding Company are keeping up their reputation as one of the leading private firms from which our ironclad navy has largely been recruited. It is now 27 years since this Company launched the first armour-clad seagoing ship named the *Warrior*, and since that time these works have been kept in fair activity in turning out the enormous amount of nearly 130,000 tons of iron-clad vessels for Government purposes. On May the 9th this firm successfully launched the *Sanspareil*, which is a sister ship to the *Victoria*, recently launched by Messrs. Armstrong, Mitchell & Co., of Newcastle. She has a total displacement of 10,470 tons, and the engines will indicate up to 12,000 H.P., with forced draught, the engines being made by Messrs. Humphreys, Tennant & Co. The *Sanspareil* is divided into a very large number of watertight compartments, amounting to no less than 170, requiring over 900 watertight doors, and there are altogether 55 engines on board of her. The launch was successfully conducted by Lord George Hamilton, who, in the course of his speech, gave some interesting details of the vessel originally bearing the name of the present one. The original *Sanspareil*, as its name indicates, was a French vessel, taken by the English in 1794, when it became one of the most effective in the navy. This was afterwards replaced by another English-built vessel, very much of the same type, with merely a slight increase of tonnage displacement. The comparison between the present *Sanspareil* and its immediate predecessor is of course startling. We are glad to see the present Government shows an admirable disposition to place as many orders as possible with private firms, as we have little doubt but that in this way excellence of material and workmanship will be best ensured, as also important advantages gained by the nation, in that private establishments are thus prepared with all the necessary plant and experience to aid the Government in turning out increases for the iron-clad navy, as or when they may be required in any emergency.

MUCH interest has latterly been taken in the intelligent education as far as possible of captains and owners of vessels as to the capacities and qualities of the vessels they own or sail. Mr. A. Denny has contributed some very interesting additional points of information peculiarly applicable to such circumstances with the object of enabling the owners of steamers built by them to understand and work their steamers to advantage, and to induce them to send the builders useful criticisms. Mr. Denny first proceeds to define the most important technical qualities of a ship, so as to give the owner or captain a comprehensive idea of the essential qualities of a vessel as summed up from a builder's point of view. Mr. Denny enumerates seven items of quality which he considers of great importance, namely: first, deadweight capability; second, speed and power; third, stability; fourth, trim; fifth, measurement capacities; sixth, steadiness; seventh, strength. These respective qualities are explained and defined in the handbook in which this information is collected in such a way that any person with a fair knowledge of arithmetic or language may understand the bearing of the laws which govern these various qualities. Of all these points perhaps the explanation and intelligent appreciation of stability on the part of known scientific people is the most difficult, and the author endeavours to impress the principles upon the captain by providing him with an apparatus and diagrams by which he can practically test the stability of his vessel before going to sea. Mr. Denny states that experience proves that an ordinary captain with care may by direct experiment construct a sufficiently accurate diagram as to the stability of any vessel of which he may be captain. The apparatus consists of a pendulum having attached to it a thin wood baton, the working edge of which is in line with a knife edge. This knife edge is attached to a flat iron rod about 6 ft. long, fastened to the top of which is a wooden board parallel to the plane of the iron disc, and so arranged that the back of the wooden baton just clears its face. To the back of this board is attached a brass slotted quadrant, and two screw nails passing through the slots serve to attach the instrument to any transverse bulkhead; at the same time the quadrant gives a certain latitude of adjustment for initial list in the steamer. On the wooden board is pasted a diagram, so that others may be fixed in the correct position when an observation is to be made. It is only necessary in employing this apparatus that a constant inclining weight should always be used by a captain wishing to test the stability of his vessel. It was found that for a steamer of 5,000 tons gross it was sufficient to fill two 30-feet lifeboats on either side alternately. The inclining moment so obtained was ample for all purposes of the diagram. When the captain desires to perform an inclining experiment, he simply rigs up his pendulum with diagram attached. He sees that his ship is free from all attachments, and that there is no free water in the bottom

or bilges of the ship. He then adjusts the pendulum frame to zero, on the assumption that the vessel is riding practically perpendicular. He then fills the boats on one side, marking the angle to which the pendulum travels, then empties that set of boats and fills those of the other side, obtaining a corresponding mark for the heel in the opposite direction. From these intersections on the observation diagram the stability of the vessel may be ascertained, and various diagrams prepared by Mr. Denny's firm, and supplied to the shipowners, will give great variety of information, such, for instance, that by the movement of the pendulum the captain is informed by the experiment how many tons he may add to his 'tween decks with safety. There is little doubt that, were a captain to take the trouble to use this apparatus, it would rapidly lead to a thorough knowledge of his vessel which would prove invaluable to him.

THE carriage of petroleum in bulk is a trade that has lately been largely developing. The amount of petroleum imported into this country, both from Russia and the States, is largely on the increase, and promises to be one of the most lucrative of shipping businesses. The rapid fall in price in petroleum of late years has given a great impetus to its use, both for domestic and general commercial purposes. Petroleum is now being largely utilized for power purposes, both direct, as an explosive agent in so-called petroleum engines, and also as a combustible in ordinary boiler furnaces. As an explosive agent in petroleum engines it has the advantage of representing a large amount of available power in very small compass, and it can now be readily bought anywhere. It is thus readily obtainable and easily stored in situations where gas is not available for gas engine purposes. As a combustible much attention and experiment has been lately devoted to its adaptation by steam or air jets to the furnaces of sea-going or other boilers, and with much success. In such circumstances it is claimed that more available power, as compared with coal, can be stored in less bulk and with less weight on board ship, thus leaving available a larger margin of space and tonnage for freight purposes. Lamps burning some form of refined petroleum are also being now largely used for domestic lighting, in preference to gas. All these expansions in the profitable employment of petroleum are naturally creating a brisk and rapid increase in its importation and sale. To carry such a class of freight economically it is evident that vessels should be designed especially for the purpose, with suitable tanks, and that especial appliances should be provided for the loading and discharge of the oil by piping. As petroleum is a somewhat dangerous substance to carry and transfer, without due precautions being taken against explosion, by reason of its inflammability and its tendency to give off light inflammable gases, special precautions in the fitting of the tanks, pipes, or apparatus of transfer, to prevent evaporation into the atmosphere, leakage, or possible access of a light or spark, have to be had regard to; and the whole transport and handling of the substance requires systematizing and arranging. We see that lately a new Limited Company has been floated, under the most influential patronage, for the storage and transport of petroleum, and we have no doubt that such an enterprise, if skilfully conducted, will be most remunerative. It must be noted that vessels bringing home petroleum cannot possibly expect to carry a similar freight back, hence some ingenuity and skill must be evinced by the owners of petroleum carrying vessels to adapt them also to carry some form of profitable return cargo. Here is evidently a fresh field for the shipping trade, and we shall watch its development with interest.

THE necessity which is now generally recognized for the accurate investigation of the stability of vessels by shipbuilders and others has led to the employment of paper models for the determination of the various curves of stability. To obtain these curves by calculation is a matter of very long and arduous mathematical toil, and any experimental method which will serve to arrive at this result will be a great boon to shipbuilders and the practical staff engaged on such work. Mr. Heck communicates to the Institution of Naval Architects a series of experiments obtained by the aid of a paper model and a light balance, and the results of trials of this apparatus have given a very close approximation of the curves obtained by calculation. The paper models referred to are sections of the hull of a vessel cut at intervals of about one-twelfth the length. In order to ensure that the centre lines of the various sections should coincide, two small square holes were cut out of the models coinciding with the two projecting pins or dowels fixed on the metal plate. The sections coated with ordinary spirit varnish are placed over the pins and thus kept fair to each other; and rapidly and accurately joined together, and is found to be quite impervious to water, and is mounted on a suitable balance which is very simple, and provided with two similar vertically projecting arms on either side of the fulcrum. The balance is mounted over a tank and the two similar arms being both immersed in water neutralizes mutually the effect of their displacement. The model is attached to one of the

vertically dipping arms, and is placed at a series of angles to determine the moment of buoyancy. Water is poured into the tank to immerse the model to any desired depth, and two scale pans are provided, one to balance the weight of the model and the other to balance the upward pressure of the water. By this means the pressure of buoyancy in any desired angle of the model and any desired depth of immersion may be readily arrived at, as also the righting moment. As the results have proved so accurate in the employment of this model, we should think that there would be no difficulty in the future for ship draughtsmen of even moderate mathematical attainments being able to determine experimentally, with proper care, all necessary curves of stability and pressure of buoyancy for various displacements of any vessel that it may be desired to build.

THE NEWCASTLE-UPON-TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

JUBILEE YEAR, 1887.

THE Jubilee Exhibition at Newcastle-on-Tyne was originally promoted by the North of England Institute of Mining and Mechanical Engineers, but ultimately various industries, such as shipbuilding, ordnance, marine and other engine works, chemical manufactories, iron and steel works, lead works, etc., have been included in its scope.

The Exhibition is in an enclosed area of 31½ acres, on the Newcastle Moor, the main building consisting of four large courts, enclosing a square of 2½ acres.

The most important feature outside the buildings is the Old Tyne Bridge, which has been reproduced in imitation of the original one built about A.D. 1250, and partially destroyed by the great flood in November, 1771, while the large lake across which it is erected, has been further utilized for military engineering, and for the exhibiting of lifeboats, etc.

In addition to the main buildings, adjoining them is a theatre, picture gallery, &c., and altogether the arrangements appear to be most suitable both for instruction and amusement.

A feature in the management of the Exhibition is the forward state the arrangements were in on the opening day. In this respect it compares favourably with other exhibitions.

It is to be regretted that, *e.g.*, in the naval architecture department, the whole of the ship models have not been arranged, so that they could form a *coup d'œil* which was so successfully managed at Liverpool last year, but there is a compensating advantage, in that none of the models are skied, the buildings at Newcastle not being so lofty.

Owing to the arrangement of the exhibits, it will scarcely be practicable to divide those we notice into carefully divided classes; and it will be more convenient to our readers, in our detailed account of this Exhibition, if we as far as possible follow the order assigned in the official catalogue.

Necessarily we cannot describe all that is to be seen, but only such objects as may appear of sufficient interest.

The principal entrance leads directly into the North Court, and turning to the right hand, we come to a recess where are found the exhibits first in the catalogue. These we will proceed to notice.

Mr. R. J. Turk, boat, punt, and canoe builder, Kingston-on-Thames, exhibits a beautifully-finished full-sized *Nautilus* sailing and paddling canoe, completely fitted in every respect. This craft is built on a new style, with improved rudder, centre board, &c., and was the winner of the 1885 Challenge Cup. The *Nautilus* is fitted with self-reefing gear sails, which can be raised or lowered when sailing dead before the wind. Amongst Mr. Turk's exhibits is his very ingenious "Radiz" patent folding centre-board.

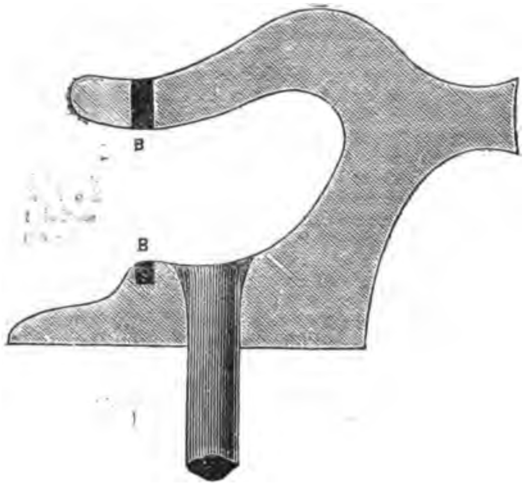
Mr. William Mills, engineer, Southwick, Sunderland, has on view a working model of a ship's boat fitted with Mills' instantaneous engaging and disengaging hooks, which have been approved by the Board of Trade for passenger and emigrant vessels. We have previously described and illustrated this gear, which has been supplied to boats on board the steamers of the India-Rubber and Gutta-Percha Telegraph Company, the Eastern Telegraph Company, the Austrian Lloyds', the Union Steamship Company, the China Shippers' Steam Navigation Company, Mr. Vanderbilt's new yacht *Alva*, &c., &c. At the Liverpool Exhibition last year Mr. Mills obtained the highest award and gold medal in competition with eleven boat lowering gears. What will have greater weight with those interested in having the best and safest kind of boat detaching gear, is that he also received a gold medal, the *only* award made by the Mercantile Marine Association, the council of that body, consisting of about twenty experienced mercantile marine commanders, forming the jury of award. This was also in competition with eleven rival gears.

Mrs. A. M. Wood, 13, Delahay Street, Westminster, London, S.W., has on view models illustrating three of her patents in which specially manufactured india-rubber, in combination with cork and other material, plays such an important part. In a report last year upon the practicability of utilizing the various inventions of Mrs. Wood, Sir Edward J. Reed, K.C.B., F.R.S., M.P., suggested that the name of "Woodite" should be given to this improved elastic material, and as such it will always doubtless be known. Whatever may be the success which attends this new material as backing or facing of armour, there is doubtless a great future in store for it. Two of the models exhibited by Mrs. Wood are of boats in which "Woodite" forms a principal feature. The first is a double reversible patent lifeboat, with central steel tubes sheathed with "Woodite," and the second a single double-grooved lifeboat, adapted for general use. It is claimed by the inventor that either of these form of boats, constructed in accordance with her patents, are uncapsizable, unbreakable, unburnable, and can be used either side uppermost, as well as having increased stability and buoyancy than any other boats. The third model represents a patent oar formed of "Woodite" with a hook at the end of the blade. One of the features of these patent oars is that they can be easily converted into personal life-floats, and in the opinion of Sir E. J. Reed, "their use would result in the saving of many a life from fatal boat accidents."

Messrs. Capito & Hardt, of 63, Queen Victoria Street, London, E.C., exhibit the "Rung" pneumatic speed indicator. It consists of a rotator which is driven from the shaft of the engine, of which it is desired to obtain the speed; the vacuum meter indicator being placed where convenient. The "Rung" pneumatic speed indicator does not register the total revolutions, as is the case with mechanical counters, but shows at a glance at what number of revolutions per minute the engines are travelling. It has met with favour abroad, and is fitted to the engines of several of the steamers in the Danish Navy. Especially on trial trips when the engine room is not provided with a counter, the "Rung" pneumatic speed indicator would be found very useful in facilitating the calculation of the I.H.P. A similar rotator is also being exhibited at this stand, by which automatically the information is transmitted to an indicator on the captain's bridge, as to whether the engines are going ahead or astern. There patents display ingenuity on the part of the inventor, but it is difficult to foretell whether they will be generally adopted.

Messrs. Sample and Ward, of Blyth, exhibit a working model, &c., of their now widely-known patent automatic detaching gear for ships' boats, which has been so highly approved of as to be adopted by numerous shipowning firms. Having previously described in detail this useful invention, for which a gold medal was awarded at the Fisheries Exhibition, and the highest award at the North-East Coast Exhibition at Tynemouth, in 1882, it is now unnecessary to more than draw attention to it. A recent patent invented by Messrs. Sample and Ward is a belaying cleat, to be fitted in ships' boats instead of the rings commonly fitted to which the hooks on the blocks of the boat-davits are attached, at the time of raising or lowering the boats. As will be seen from our illustration, it is a simple contrivance to which a chain or rope can be in a moment securely attached, whereas it is a work of difficulty to attach the hook on a davit-block to the ring in the boat when a heavy sea is running. Failure to promptly attach or let go the boat, as the case may require, probably leads to the frequent loss of human lives, which, it is alleged, would be avoided by the adoption of this latest patent of Messrs. Sample

and Ward. The cleat is bolted down to the keel of the boat with a bolt as indicated at A (the bolt in our illustration is shown broken off). In the event of it being found convenient from any cause to use this patent cleat in combination with davit-blocks



having hooks, provision is made at B for the fitting of a safety pin; but to obtain the real advantage offered by this patent, instead of a hook to the davit block, a length of chain or rope should be attached to the lower end of the blocks, with which to take a couple of turns round the cleat.

Messrs. R. Irvine and Co., shipbuilders and ship repairers, Harbour Dockyard, West Hartlepool, exhibit a number of photographs showing the means they adopted for the floating and raising of the full-rigged ship, *British Enterprise*. This was a task of no mean importance, as the vessel was one of the largest sailing vessels afloat, being over 1,700 tons gross register. The *British Enterprise* had sunk in the River Tyne, heeling over on to her broadside into the bed of the river, and the gigantic nature of the undertaking will be more fully realized when it is stated that at the time, in addition to having a complete outfit and all stores, the *British Enterprise* had in her holds a cargo of 2,400 tons. Instead of being placed in the position they would occupy according to the number on the catalogue, these photographs are to be found at the north end of the organ, near the working dairy. They are well worthy of an inspection, especially by all interested in salvage operations, and give a good idea of the work performed in raising the *British Enterprise*.

Mr. J. H. Ritchie, naval architect, &c., 57, Fenchurch Street, London, exhibits three models of vessels, designed by him, two of which have been built, while the third is that of a fine lined paddle yacht, to attain a speed of seventeen knots, on a draught of water of 9 ft. 6 in. The dimensions are:—Length, 250 ft.; breadth, 27 ft.; depth, 13 ft. 6 in.; and the tonnage B.O.M. 906. The other models represent respectively the screw steamer *Monarch*, built for H. M. Postmaster General, and the steam yacht *Theodora*. The *Monarch* is used in the laying and repairing of submarine telegraph cables, and has proved a serviceable and efficient vessel. Its dimensions are:—Length, 240 ft.; breadth, 33 ft.; depth, 19 ft. 4 in., and the tonnage B.O.M. 1,348, the engines being of 195 N.H.P. The *Theodora* is a suitably designed steam yacht, 165 ft. long, with 25 ft. beam, and 15 ft. 4 in. depth of hold.

The Sunderland Shipbuilding Company, Limited, Sunderland, have been contented with forwarding only one model to the Exhibition. It is, however, specially well finished, being a full model in a glass case, having all deck fittings and other *minutæ* carefully shown to the scale of one quarter of an inch to the foot.

We may here remark that there is a great paucity of exhibits from the Wear-side firms, some of the largest and oldest established being entirely unrepresented. Seeing the magnificent character of the exhibits of several Sunderland shipbuilders at Liverpool last year, more especially those of Messrs. William Doxford & Sons, of Pallion, it is all the more remarkable. Is it the intention of the Wear shipbuilders to promote an exhibition in 1888 or 1889 to rival the present one in Newcastle-on-Tyne? If so, we wish them every success.

The vessel represented by the model exhibited by the Sunderland Shipbuilding Company is the Atlantic liner *Chateau Leoville*, built to the order of La Compagnié Bordelaise de Navigation à Vapeur de Bordeaux. The registered dimensions are:—Length, 365·5 ft.; breadth, 41 ft.; depth, 22·2 ft. The tonnage under deck is 2,353 tons, gross register, 3,462 tons, and net register, 2,253 tons. The vessel has seven bulkheads, is rigged as a three masted schooner, and classed 100 A at Lloyds. The engines are compound 44 in. and 83 in. diameter of cylinders, 48 in. stroke, 80 lbs. working pressure, and are constructed by the North Eastern Marine Engineering Company, Limited, Sunderland.

Mr. George Thwaites, of 2, Church Row, Stockton-on-Tees, amongst his exhibits shows Smiles' patent side-light cutting machine. This patent hole-cutting machine, having been designed with a view to lightness, is specially suited for hole-cutting in bulkheads, tanks, as well as through a vessel's plating for side-lights and other circular holes. It is made in three sizes, the smallest cutting holes from 4 in. to 9 in. diameter, and the largest from 8 in. to 21¼ in.—the latter only weighing 30 lbs. The tool which does the cutting weighs only two ounces, and lasts a considerable time. Several shipbuilding firms on the Tees, Wear, and Tyne have adopted it, and speak highly of its usefulness and suitability. It need scarcely be pointed out that there is an undoubted advantage in using a circular hole-cutter over the old methods of either cutting holes by hand or punching them out by a small punch, and then cleaning up the hole. Then as to the question of outlay of capital, these patent hole-cutters have a manifest advantage over large hydraulic punches with their numerous costly dies.

Continuing our survey of the exhibits in the North Court, at the extreme right of the entrance, we see several stands devoted to the enterprising Palmer's Shipbuilding and Iron Company, Limited. On their stand against the wall they display a number of exhibits illustrative of iron and steel manufacture, as carried on at their extensive works at Jarrow-on-Tyne. These consist of samples of hæmatite and Cleveland pig-iron, and of the comparative quantities of materials used in making pig-iron, besides other samples of minerals and specimens of finished iron and steel. There is also a model of a blast furnace as erected at this company's works, which will be doubtless viewed with interest. The Jarrow blast furnaces are 85 ft. high and 26 ft. diameter of bosh, and have, in connection with each, two of Whitwell's patent hot blast stoves, 65 ft. high and 22 ft. in diameter. The Naval Architectural and Marine Engineering exhibits of Palmer's Shipbuilding and Iron Company, Limited, will be described later on.

Continuing our examination of the exhibits on the north wall of the North Court, we come next to those of

Messrs. Joseph L. Thompson & Sons, shipbuilders, North Sands, Sunderland, who have not such a large collection of models at this Exhibition as they had at the Liverpool one, exhibiting only four models, two of which are in glass cases, and of special interest. The vessels represented are the screw steamers *Hubbuck*, *Kaison*, *Lancashire Witch*, and *Moyune*. As we noticed the two former ones in our article, "Among the Models," in the July number, 1886, we will now only refer to the two last-mentioned, which have been delivered to their owners during the current year. The *Lancashire Witch* is a steel steamer, the first of the fleet of the New Isle of Man Steam Navigation Company, Limited. Her dimensions are: Length over all, 225 ft.; breadth, 30 ft.; depth to awning deck, 21 ft.; and depth of hold to main deck, 13 ft. 6 in. This vessel has been constructed under special survey of the Board of Trade, and considerably in excess of the requirements of Lloyd's Register for the 100A class, and is intended to ply between Liverpool and the Isle of Man, and has accommodation for about 750 passengers. A spacious promenade deck is provided for the first class passengers, and ample accommodation is provided on the main deck for first and second class passengers, the principal saloon being luxuriously fitted on the latter deck, and below it the dining saloon. There are also ladies' cabins, lavatories, smoking room, &c., all fitted up with steam-heating pipes as well as the usual fittings. The saloon accommodation for the second class passengers is unusually good, and the cooking arrangements, bars, &c., are all suitable to the exigencies of the service on which the vessel is being placed. The whole of the saloons, &c., are lighted with the electric light, incandescent lamps of the most approved design being employed. The installation is fitted by Messrs. Dorman & Smith, of Manchester, and the generating machinery is close to the engine rooms. The steering gear is Lynn's horizontal steam steering gear, and is placed amidships, and the windlass is Emerson & Walker's direct acting. There are four boats, which are fitted with Mr. William Mill's patent disengaging

gear. Glancing at the lines of the model, they are seen to be very fine, and on repeated trials the vessel has proved to be very fast. The engines and boilers have been constructed by Mr. John Dickinson, of Palmer's-hill Engine Works, Sunderland, and are of the latest type. The engines are triple-expansion, the cylinders being 23 in., 37 in., and 60 in. diameter, with a stroke of 36 in., and are fitted with Dickinson's patent crank shafts, which are placed at the angle of 120 degrees, and consist of three duplicate pieces. Both the crank and propeller shafts are 10 per cent. in excess of the Board of Trade requirements. The slide valves of the engines are of the common type, actuated by Bremmes' patent valve gear, the low pressure being double ported; and there is steam starting and reversing gear. Buckley's patent rings have been fitted to the pistons and Kinghorn's valves to the air-pumps. Rickaby's metallic packing is fitted in the piston rod stuffing boxes. The boilers are four in number, constructed of Landore Siemens'-Martin steel, 10 ft. 9 in. diameter, 9 ft. 9 in. long, fitted with Fox's corrugated flues, 3 ft. 2 in. diameter, 7 ft. long, each having separate combustion chambers. The effective heating surface is 1,250 superficial ft., and the total surface 5,000 superficial ft. The working pressure is 160 lbs. per square inch. A donkey boiler is also provided, 9 ft. high, 4 ft. diameter. On the 23rd April the vessel proceeded on a preliminary trial, when the engines ran smoothly and a mean speed of nearly 16 knots was obtained. It was, however, considered likely that this good result could be further improved by increasing the diameter and pitch of the propeller. Accordingly a new one was put in hand, and it was fitted complete and steam got up in six days. On the subsequent trial, on April 30th, and on the official trial, there was an improvement in the speed, the mean of 16·25 knots or 19 miles per hour being obtained on the measured mile in runs with and against the tide—the I.H.P. exceeding 2,000. We have given at detail this account of the *Lancashire Witch*, as the building of this steamer is a progressive step in the development of shipbuilding on the Wear, she being the fastest yet built at Sunderland. It may be added that the building of the *Lancashire Witch* only occupied twelve weeks, the keel being laid in December last, while the launch occurred on March 23rd, 1887. The *Moyune* is a steel screw steamer built for the China Shippers' Mutual Steam Navigation Company, Limited, London. This vessel is of the following dimensions:—Length, 352 ft.; breadth, 40 ft.; depth (moulded), 27 ft.; and has accommodation for 50 first class passengers. The hull is constructed throughout of Siemens'-Martin steel, and the scantlings are in excess of Lloyd's register rules for the 100A class. Six steel water-tight bulkheads, extending to the upper deck, are fitted, and both the main and upper decks are of steel sheathed with teak; and the necessary arrangements have been made to comply with the Admiralty requirements. The engines are of the triple-expansion type, by Messrs. T. Richardson & Sons, of West Hartlepool, the cylinders being 31 in., 49 in., and 78 in. diameter, 51 in. stroke, indicating 3,000 H.P. The boilers work at a pressure of 150 lbs., and forced draught apparatus in accordance with the engine builder's patent has been fitted to the furnaces. The *Moyune* is suitably designed in every respect for the China trade, and attains a speed of 14 knots per hour. In closing our account of Messrs. Joseph L. Thompson and Sons' exhibits, it may be remarked that up to January, 1887, they had launched 236,569 tons of shipping since the firm started work in 1846, and during the first four months of the present year they have launched six large steamers. Hydraulic power is largely used by this firm; gas is employed to heat the plate and angle furnaces, and Archer's patent bevelling machine is also regularly in use.

Next in order is the large collection, mostly of half models, of Sir Wm. Armstrong, Mitchell & Company, Limited, Newcastle-on-Tyne. Many of the models exhibited by this company, were at the Liverpool Exhibition last year, and were described in our July number, 1886, pages 109-110; notably the set of half models of gunboats built for various governments, and the similar set of petroleum carrying vessels. A valuable addition to this company's exhibits of models, is that of the oil-in-bulk steamer *Minister Maybach*. This vessel has a load displacement of 5,000 tons, and is capable of carrying 3,000 tons of pretoleum, besides 20 days' fuel, on a draught of water of 20 ft. This vessel is constructed on Swan's patent "conical" double bottom system, the details of which are admirably shown on the back of the half model of the *Minister Maybach*, as well as all the internal arrangements of the vessel, engines, boilers, pumps, &c. A portion of the model at amidships is full, and the construction of the vessel transversely at this point is clearly shown, making this miniature specimen of naval architecture one of the most instructive as well as interesting exhibited by any firm of shipbuilders. There are three models of mercantile vessels in the collection of Sir Wm. Armstrong, Mitchell & Co., Limited, which although alluded to previously may be further described. The first is that of the floating dock built in 1877 for the Dutch Government service, in connection with the Harbour Works in Java. This craft is 181 ft. 6 in. long, 52 ft. breadth, 20 ft. 9 in. deep, and consists entirely of horizontal and vertical cylinders, which were completely riveted, and caulked in this country, the dock being launched and tried previous to its shipment to Java, where it was re-erected by merely bolting the pieces together, no rivetting whatever being required, an important *desideratum* where only unskilled labour is available. It was built for docking dredgers and hopper-barges, a model of one of which is shown in the dock. The second model referred to above, is that of the 100-ton floating crane *Atlas*, built in 1885 for the Mersey Docks and Harbour Board. The hull of this craft is 457 tons register, 780 tons displacement, and of the following dimensions:—Length, 130 ft.; breadth, 48 ft.; depth, 10 ft. The engines are of the high pressure type, with inverted cylinders—four in number—11 in. diameter, 12 in. stroke, and one steel boiler by Messrs. Ross & Duncan. The I.H.P. is 170 and speed of the craft 5 knots per hour. The crane will lift 100 tons at a radius of 30 ft., and 30 tons at a radius of 47 ft., the counterbalancing being regulated by water ballast. The third model we give additional particulars of is that of the well-known iron cable steamer *Faraday*, which was built in 1874 to the order of Messrs. Siemens Bros. The principal dimensions of this vessel are:—Length, 360 ft.; breadth, 52 ft. 3 in.; depth, 36 ft.; and gross register tonnage 4,908 tons. The engines by Messrs. Thos. Clark & Co., of Newcastle-on-Tyne, are compound, 39 in. and 68 in. diameter of cylinders, 48 in. stroke; with six iron boilers having three furnaces each, indicating 2,000 H.P., giving the vessel, with a displacement of 10,000 tons, a speed of 11 knots per hour. This vessel has the peculiarity that her bow and stern are of precisely the same form, including a rudder at each end, so that if it is desired, while laying the cable, to haul it back on board, this can be done without turning the steamer, which under many circumstances might involve a breakage of the cable.

There are a number of mercantile vessels represented by models which we do not remember seeing at Liverpool, amongst them are the following:—The s.s. *Nubian*, built in 1876 for the Union Steamship Company, Limited, Southampton, of the following dimensions:—Length, 359 ft.; breadth, 38·6 ft.; depth, 27·2 ft.; and of 2,500 tons under deck, 3,091 tons gross register, and 1,998 tons net register. This vessel has a poop 225 ft. long, and a topgallant forecastle, 52 ft. long, four bulkheads, &c., and has a load displacement of 5,400 tons. The engines were constructed by Messrs. T. Clark & Co., of Newcastle-on-Tyne, and are compound surface-condensing, 47 in. and 86 in. diameter of cylinders, 48 in. stroke, the boilers having a working pressure of 70 lbs. per square inch, and a speed of thirteen knots per hour has been attained by the vessel.

The s.s. *California*, built in 1883, is a vessel of not very dissimilar dimensions, 5,500 tons load displacement, and 12 knots speed.

The s.s. *Pouyer Quertier* is a twin screw cable steamer, built in 1879. The dimensions of this vessel are:—Length, 238·2 ft.; breadth, 35·9 ft., and depth, 22·9 ft. The vessel is constructed on the three deck rules, is classed 100 A at Lloyd's, and is fitted with poop, hurricane house, and topgallant forecastle. The tonnage under deck is 1,324 tons; gross register, 1,385 tons, and net register 882 tons. The engines are compound surface condensing, 24 in. and 40 in. diameter of cylinders, 30 in. stroke, and 70 lbs. working pressure, by Messrs. Thos. Clarke & Co., of Newcastle-on-Tyne. The *Pouyer Quertier* has a displacement of 3,150 tons, and 10 knots speed, and is owned by the Compagnie Francaise du Telegraphe de Paris *et New York*, of Havre.

The *Sir William Armstrong* is a screw-steamer, built in 1884, owned by Messrs. W. Dickinson, of Newcastle-on-Tyne, of the following dimensions:—Length, 300·6 ft.; breadth, 37·1 ft.; and depth, 24·3 ft.; and tonnage under deck, 2,111 tons; gross register, 2,255 tons; and net register, 1,474 tons. The steamer has a poop, bridge, and forecastle, and is fitted with compound engines 36½ in. and 68 in. diameter of cylinders, 42 in. stroke, and 200 N.H.P. The working pressure is 90 lbs., and the engines and boilers were constructed by Messrs. Blair & Co., Limited, of Stockton-on-Tees. The load displacement of the *Sir William Armstrong* is 5,000 tons, and the vessel attains a speed of 10 knots.

The *Lady Armstrong* is an iron screw steamer built in 1883, owned by a limited company, named after the vessel, managed by Messrs. Adam Hamilton & Co., of Greenock. The vessel has a poop, hurricane house and forecastle, and five bulkheads, and is of the

following dimensions:—Length, 286 ft.; breadth, 37·1 ft.; depth of hold, 23 ft.; depth moulded, 25 ft. 9 in. The engines are compound surface condensing 34 in. and 66 in. cylinders, 42 in. stroke of 235 N.H.P., by the Wallsend Slipway and Engineering Company, Limited. The load displacement is 4,700 tons, and the speed per hour 10 knots.

The iron screw steamers *Hamburg* and *Paranagua* were built in 1878 for the Hamburg Sub-American Dapfschraarts. These vessels are 270 ft. in length, 33·8 ft. breadth, 23·6 ft. depth, 1,644 tons gross register, and 1,284 tons net register. The engines are compound, 34 in. and 62 in. diameter of cylinders, 42 in. stroke, of 220 N.H.P., 3,600 tons load displacement, and 10 knots speed.

The *Sverre Sigürdsson* is a steel screw steamer built in 1882 for the Nordenfjldske Dampskbs Selkskab, of Thrndljin, of 867 tons gross register, 526 tons under deck, and 589 tons gross register. The dimensions are:—Length, 186 ft.; breadth, 28 ft.; depth, 14·8 ft. The engines are 120 N.H.P., compound surface condensing 30 in. and 53 in. diameter of cylinders, 30 in. stroke, 75 lbs. working pressure, made by the Wallsend Slipway and Engineering Company, Limited. The load displacement is 1,300 tons, and the speed per hour 11 knots.

The *Egret* is one of the General Steam Navigation Company's steamers, built in 1883, of the following dimensions:—Length, 190·6 ft.; breadth, 27·7 ft.; depth, 14·4 ft. This steamer has a raised quarter deck, hurricane house and forecastle, and is fitted with compound engines 25 in. and 50 in. diameter of cylinders, 27 in. stroke, 80 lbs. pressure, 98 N.H.P., made by the Wallsend Slipway and Engineering Company, Limited.

The *Goritz* is a paddle steamer, built in 1882, of 300 tons displacement at 2 ft. 9 in. draught of water, at which it attains a speed of 11 knots, with an I.H.P. of 700.

The *Simson* is a paddle tug steamer, built in 1878 for A. D. Zurmuhlen, of Amsterdam; 130 ft. in length, 21 ft. beam, 11 ft. depth of hold, 216 tons gross register, and 75 tons net register. The engines are of 30 lbs. working pressure; two cylinders, 34 in. diameter, 60 in. stroke; 110 N.H.P., by Messrs. Thompson & Co., of Newcastle-on-Tyne. The displacement of the *Simson* is 330 tons, and the speed 11 knots, with 450 I.H.P.

A somewhat larger paddle tug steamer is the *Hercules*, built in 1877, of 420 tons displacement, and the same speed as the *Simson*, with 550 I.H.P.

The steam launches *Midge*, built in 1880, and the *Dart*, built in 1883, are contrasts to the larger vessels; as also the paddle yacht *George Crow*, built in 1867.

The *Africa* is a screw steamer trawling vessel, 100 ft. in length, 19·8 ft. breadth, 10·1 ft. depth, built in 1883 for Mr. C. Dyble, of North Shields. This vessel is 122 tons gross register, 280 tons displacement. The engines are 21 in. and 38 in. in diameter of cylinders, 24 in. stroke, of 100 lbs. working pressure, by Messrs. Ross & Duncan, of Glasgow, attaining a speed of 11 knots per hour.

The *Swift* is a steel screw steamer, built in 1882, of the following dimensions:—Length, 110 ft.; breadth, 20·1 ft.; depth, 10·2 ft.; and the tonnage under deck 167 tons, 190 tons gross register, 98 tons net register. The engines are compound, 14 in. and 25 in. diameter of cylinders, 18 in. stroke, 70 lbs. working pressure; made by the Wallsend Slipway and Engineering Company, Limited. The *Swift* has a displacement of 360 tons, attains a speed of 8½ knots an hour, and is owned by J. N. Carr, of Maryport.

The *Miraflores* is a screw tug-steamer built in 1882, of 62 tons net register, 148 tons gross register, and of the following dimensions:—Length 100 ft., breadth 22·2 ft., depth 11 ft., built to the order of the Compagnia Comercial de Remolcadores of Valparaiso. The engines are 19 in. and 36 in. diameter of cylinders, 24 in. stroke, 75 lbs. working pressure, by Messrs. Ross and Duncan, of Glasgow, and on a displacement of 350 tons attains a speed of 10 knots per hour.

The *Maha Vajirunhis* built in 1881, is a screw steamer of 2,150 tons displacement and 12 knots speed. The registered dimensions are:—Length 253 ft., breadth 32·2 ft., depth 17·5 ft.; the tonnage under deck 1,018 tons, gross register 1,176 tons, and net register 704 tons. The engines are compound 34 in. and 66 in. diameter of cylinders, 42 in. stroke, 80 lbs. working pressure, constructed by the Wallsend Slipway and Engineering Company, Limited. The *Maha Vajirunhis* is owned by the Netherlands India Steam Navigation Company, of Batavia.

The *Osmanli* is a screw steamer built in 1880 for the Moss Steamship Company, Limited, of Liverpool. The dimensions of this steamer are:—Length 330·5 ft., breadth 35 ft., depth 23 ft. 6 in.; of 2,163 tons under deck, 2,283 tons gross register, 1,492 tons net register. The engines are compound surface condensing 35 in. and 70 in. diameter of cylinders, 48 in. stroke, manufactured by Messrs. R. & W. Hawthorn & Co., of Glasgow. The vessel's load displacement is 5,200 tons and the speed of 11½ knots has been obtained.

The *Santos* is an iron screw steamer built for the Hamburg South American Steamship Company, of 2,273 tons gross register and 1,610 tons net register. The registered dimensions are:—Length 314·6 ft., breadth 36·1 ft., depth 27·4 ft. The engines are compound 40 in. and 72 in. diameter of cylinders, 48 in. stroke; 270 N.H.P. by Messrs. Thompson & Co., of Newcastle-on-Tyne, and the vessel attains a speed of 11 knots on a load displacement of 4,800 tons.

The *Australia*, *America*, *Polynesia*, and *Manatchy*, are also mercantile screw steamers represented by their models in Sir Wm. Armstrong, Mitchell & Co.'s, Limited, principal naval architectural stand. There are also a number of war vessels' models, besides a few on separate stands, and notice of the latter of which we postpone, as they are placed near the centre of the North Court. On the large stand there are the following models of war vessels, also on view at Liverpool last year, viz., the *Protector*, the *Esmeralda*, the *Naniwa Kan*, the *Takachiho Kan*, *Yamashiro Maru* and *Omi Maru*, and the *Giovanni Bausan*. The latter is of the *Esmeralda* type but longer, being 275 ft. 7 in. in length, 42 ft. 7 in. breadth, 18 ft. 4 in. mean draught of water, 3,068 tons displacement and having twin-screws of 6,000 I.H.P. The vessel was built of steel in 1885, and is credited by the shipbuilders with a speed of 18 knots, but in the "Naval Annual" it is stated at 17½ knots per hour. She has an armour deck with plates 1½ in. thick. The armament consists of two 10-in. rifle breechloading guns, six 6-in. guns, two 2-barrel Nordenfeldt guns, two 4-barrel Nordenfeldt guns, two 6-pounder rapid fire guns, two Hotchkiss guns, and two Mitrailleuse guns. All the guns have a steel shield. There are three torpedo tubes, one fitted under the ram in the keel line, and the other two in launching positions above water. The steering gear is hydraulic. The supply of coals in the bunkers is 600 tons, sufficient for steaming a distance of 5,000 knots at the rate of ten knots per hour. According to Lord Brassey's "Naval Annual," the *Giovanni Bausan* cost £160,000. There are also several models of recently built war steamers. The first we notice is that of the Imperial Chinese protected cruisers *Chik Yuan* and *Ching Yuan*, built of steel in 1887. The dimensions are:—Length, 267 ft.; breadth, 38 ft.; draught of water, 15 ft.; and displacement 2,300 tons. The vessels are supplied with twin-screw engines of 5,500 I.H.P. and are credited with a speed of 18 knots an hour. The armament consists of three 8-in. 12-ton breechloading guns, two 6-in. 4-ton breechloading guns, rapid fire guns, and torpedo tubes. The coal capacity of the bunkers is 50 tons.

Next there is the model of the Spanish protected cruisers *Isla de Cuba* and *Isla de Luzon*, built this year of steel. The dimensions are:—Length, 185 ft.; breadth, 30 ft.; and 11 ft. 6 in. draught of water, with 1,040 tons displacement. The engines are of the latest type, and propeller twin screws of 2,200 combined H.P., attaining a speed of 15 knots an hour. The capacity of coal bunkers is 160 tons, and the armament consists of six 12 centimetre guns, torpedo, and rapid fire guns.

The next model we draw attention to is that of the Imperial Japanese cruiser, *Tsukushi Kan*, built of steel in 1883, of 1,500 tons displacement at 15 ft. draught of water, according to the "Naval Annual," as against 1,370 tons stated by the shipbuilders. The dimensions of this vessel are:—Length, 210 ft.; breadth, 35 ft. 2 in.; depth, 15 ft. The engines indicate 2,887 I.H.P., giving a speed of 16 knots, according to Lloyd's Universal Register, and 17 knots according to the Naval Annual. The coal capacity of the bunkers is given at 250 tons by the former authority. The armament consists of two 25-ton Armstrong breechloading guns, four 12-centimetre Armstrong breechloading guns, besides boat and Gatling guns.

There is also exhibited a model of a Russian armour-clad frigate, *Prince Pojarski*, built in 1868. This vessel is 4,200 tons displacement, and with a speed of 13 knots.

The recently built gunboats, *Rattler* and *Wasp*, of 670 tons displacement, and with engines of 1,200 H.P. are also represented by well finished models.

The model of the Austrian protected torpedo cruisers *Panther* and *Leopard*, built last year, must not escape notice. The dimensions, according to the "Universal Register," are:—Length, 226·3 ft.; breadth, 32·8 ft.; depth, 14 ft.; but according to the "Naval Annual" the length is 224 ft., and breadth, 34 ft. The displacement at 14 ft. draught is 1,550 tons, and the speed is variously stated by respectively the "Universal Register," "Naval Annual," and the Exhibition catalogue, as 18·3, 18·5,

and 19·0 knots per hour. These vessels have twin-screw propellers, and engines of 6,200 I.H.P. according to the "Naval Annual," and 5,600 I.H.P. by the "Universal Register." The bunker capacity is 250 tons, and the armament consists of two 12-centimetre Krupp guns, four torpedo tubes, and ten machine guns. The cost of the *Leopard*, according to Lord Brassey, K.C.B., was £200,000.

There are other exhibits on the main stand devoted to Naval Architecture, of Sir Wm. Armstrong, Mitchell & Co., Limited. Of some interest is the long list of the names of the various vessels built by this company and the late firm of Chas. Mitchell & Co., Walker-on-Tyne, reaching as they do to five hundred and four. A model of the Elswick Shipbuilding yard, and numerous photographs and paintings of war vessels, &c., are additional elements in the arrangement of the exhibits of this enterprising company.

Proceeding up the North Court, keeping still to the right hand wall as you enter, we come to the exhibits of Messrs. Robert Thompson & Son, of the Southwick and Bridge Dock Shipbuilding yards, Sunderland, who have a very effective display of photographs and models. The photographs are peculiarly interesting, inasmuch as a number of them show the extent of this firm's premises in 1860, when they were as yet only engaged in wood shipbuilding. In one photograph of that date are to be seen two wooden vessels, one of them ready for launching and the other in course of being framed. Another set of photographs give an idea of the present extent of their shipbuilding and ship-repairing facilities, and one dated 1881 shows the *Hoselaw* ready for launching at their lower yard. This photograph is of special interest, as the method of fitting the ways under a vessel to be launched broadside instead of end on is distinctly shown. Photographs of vessels built by the firm are also exhibited, including one of the barque *Embleton*, and four of the cable laying steamer *Citta di Milano*. The models are three in number; conspicious as being a full model completely rigged and complete in every detail is that of the sailing ship *Bhotan*, a vessel of 1,137 tons gross register, and of the following dimensions:—Length, 214·7 ft.; breadth, 33·9 ft.; depth of hold, 20·5 ft.

Next in order is the model of the *Citta di Milano*, which was built to the order of Messrs. Pirelli & Co., of Milan. The dimensions of the vessel are:—Length, 240 ft.; breadth extreme, 32 ft. 2 in.; depth of hold, 24 ft. Three tanks for holding cables are fitted in this vessels, and on the main deck a combined picking up and paying out machine, by Messrs. Johnson and Phillips, of London, driven by a pair of independent engines. The main engines are compound, 36 in. and 68 in. diameter of cylinders, 42 in. stroke, indicating 1,100 H.P., by Mr. George Clark, of Southwick.

The models of the screw steamers *Sumina* and *Min*, built for the Japanese Government, is the last to be noticed. These vessels are 1,401 tons gross register, 896 net register, and are of the following dimensions:—Length, 266·7 ft.; breadth, 32·1 ft.; depth 21·8 ft. The engines and boilers, indicating 1,000 H.P., were constructed by Mr. George Clark, the well known Wearside engineer.

An interesting set of exhibits is that of the Tyne General Ferry Company, Custom House Chambers, Newcastle-on-Tyne. It comprises models of some of their river passenger steamers which are all driven by paddles, including the *Lady Florence*, *Beatrice*, and *Alice*. The latter vessel is not yet complete, being built at the shipyard and slipways of the Tyne General Ferry Company. It will make the sixth vessel they have constructed of steel and of their enlarged type which accommodate 400 passengers, as against 270 in their old steamers.

Messrs. Schlesinger, Davis & Co., shipbuilders, Wallsend-on-Tyne, have at their stand twelve models of vessels of various types, showing that Tyneside firms are equal to building craft of special design, as well as the Clyde or any other shipbuilders. In several cases Messrs. Schlesinger, Davis & Co., have been content to show models of the same vessels as at Liverpool, of which we gave a full description, on page 93 of our July, 1886, number, but the composite light vessel *Puffin* is a notable exception. This vessel has only recently been constructed and delivered to the Commissioners of Irish Lights, to be placed on a stormy part of the Coast line, under the charge of that body. Special care was taken to make the *Puffin* seaworthy, and the accommodation for the crew as comfortable as possible. The principal dimensions of this vessel are as follows:—Length overall, 101 ft. 6 in., length between perpendiculars, 93 ft. 6 in., breadth extreme, 22 ft. 7 in., breadth moulded, 20 ft. 9 in.; depth of hold, 11 ft. 3 in., depth moulded 11 ft. 10 in. The *Puffin* is double planked, the inner planking being 3 in. teak, fastened to the angle-iron frames, which along with all the iron are of Consett B.B. brand, by $\frac{7}{8}$ diameter galvanized iron bolts, two in each plank through each frame. The outer planking is secured to the inner planking by $\frac{3}{4}$ in. diameter copper clenched bolts. Special arrangements are made to prevent the vessel rolling excessively, in addition to a large ordinary keel at the centre line, four bilge keels 15 in. by 9 in. being fitted in addition. Two boats are fitted on board, with davits, lowering gear, &c., all complete, for communication with the shore, saving of life, &c., and a patent purchase common windlass is fitted for hauling in mooring chains. The latter consist of two lengths of $1\frac{7}{8}$ in. cable, one of them being connected to a large mushroom anchor, while the second is held in readiness with a Trotman anchor lashed to the side, ready to be cut away should the ordinary mooring prove insecure. The signals are mounted on a steel mast in the centre of the deck. Those for the day-time consist of two large balls, six feet in diameter, placed one above the other. At night time there is a lantern house eight feet in diameter, which is secured to the mast and capable of being raised and lowered, and for this purpose a hand-winch is fitted. The light revolves, and is operated by clock-work, placed below the deck. In addition to the large steel mast, there are two smaller ones, one forward and one aft, on which fore and aft sails can be rigged to assist in steadying the craft. The remainder of Messrs. Schlesinger, Davis & Co.'s models include mail and passenger screw steamers, cargo steamers and sailing vessels, paddle and screw yachts, hopper dredger, hydraulic fire extinguisher, and towing steamer, the whole making up a splendid collection of well-designed vessels.

Messrs. T. G. Tagg & Son, Island Launch Works, East Molesey, Surrey, have besides a number of photographs of launches, boats, canoes, &c., on view, samples of their patent caulking for ships' decks, cabin-tops, topsides, deckhouse-tops, &c. This patent caulking is designed to supersede the ordinary system of driving oakum into the seams and butts of decks, and subsequent paying with tar, rosin, or other substance. Fig. 1. shows the

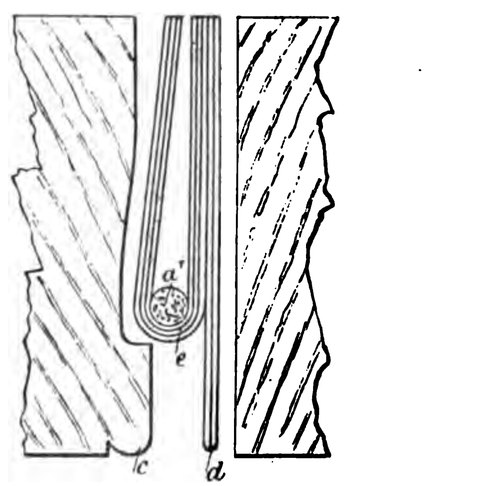


FIG. 1

method adopted when Messrs. Tagg's patent is employed. Each plank is caulked as it is laid, a folded piece of canvas or linen being placed between the open plank edges, marked E in our first illustration. The folded material is previously saturated in a description of elastic non-drying varnish or gum solution, and a cotton core, marked A, is placed as shown. One end of the canvas or linen is brought to the lower edge D of the plank, each of the planks being moulded as shown at C. The next part of the process consists in closing the two planks together, which may be effected by any approved method, when the seam assumes the appearance shown in Fig. 2. The caulking being saturated with the elastic gum, gives and takes with the shrinking and swelling of the plank, without allowing of any leakage; and as it is applied in a liquid condition, it becomes so firmly attached to the side of the plank, that when set, it will bear a direct strain equal to 4 lbs. or 6 lbs. to the square inch. The seams, when closed, are from $\frac{1}{16}$th to $\frac{1}{8}$th of an inch wide, according to the thickness of the plank, and the edges of the seam remain as sharp and true as when fresh from the plane. In the case of planks not more than $1\frac{1}{2}$ in. thick, the core (A) would not be used, and

the whole depth of the seam would be filled by the strips as shown at D, and no groove would require to be cut in the plank. In fitting the last plank in a deck, both sides are tapered, and it is driven home tight. It is well-known that the ordinary system of caulking deck planks, &c., is open to many objections. It injures the wood in reaming and driving up the oakum; it distresses the joints in tightening up the seams, and leaves an unequal expansion. After severe temperature the seams contract and the caulking becomes slack, and air, water and damp are admitted, causing loose seams, which rarely takes up, or is again made efficient by re-caulking. The cost is about 25 per cent. more than that of ordinary caulking, but the durability, tightness, and appearance of the process will more than compensate for this. Lieutenant Yonge, R.N., who has brought the system under the

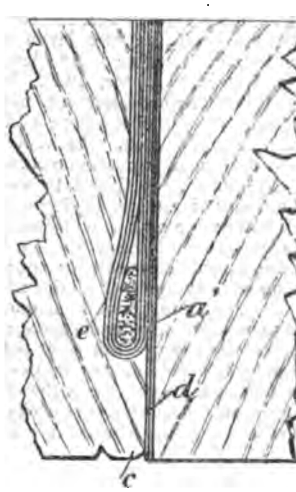


FIG. 2.

notice of the Admiralty, has most favourably reported upon it, and it has been officially reported by Lloyd's Register to be very satisfactory, while the chief engineer of the Bureau Veritas states it has important advantages, especially for hot climates. A silver medal was awarded for it at the Inventions Exhibition, and at Falmouth in 1885, and a Gold Medal at the Edinburgh Exhibition last year. A specimen portion of a deck, is exhibited at Newcastle Exhibition, which has been twice to Shanghai *via* the Red Sea, in summer, and once to New Orleans in winter, and the caulking shows no signs of shrinkage. Mr. Tagg's patent should be specially favoured for the decks of yachts, where comfort is a primary object, as the caulking being thoroughly saturated with a solution, is a great improvement upon merely paying over the upper portion of the oakum or cotton, driven between the plank edges.

Another patent, of which there is an exhibit, is Messrs. T. G. Tagg & Son's rudder-hangings for pleasure or ships' boats. Anyone who has had experience in fitting the rudder of a boat afloat, in rough or lumpy water, must have been annoyed at the loss of time and trouble caused by the ordinary method of attaching the rudder to pintles. There is also a great liability of an ordinarily fitted rudder being unshipped, a matter of no small moment when there is any risk of loss of life. These drawbacks are all avoided by the patent rudder fittings of Messrs. Tagg & Son, as there is under no circumstances the slightest difficulty in shipping a rudder so fitted, the pintle being continuous, and the entering of the rudder into the groove being above water, while under every conceivable circumstance it would be impossible for the rudder to be unshipped. We expect to find this invention largely adopted, especially in sailing and rowing pleasure craft if not in ordinary ships' boats.

Messrs. W. Milburn & Co., steamship owners, of Newcastle-on-Tyne, London, &c., have a very tastefully arranged stand, on which they display several models and drawings of their well-known steamers, which form a portion of the Anglo-Australasian Steam Navigation Company's fleet. The vessels so represented include several of the finest steamers ever built on the Tyne, viz., the s.s. *Port Pirie*, the s.s. *Haverton*, the s.s. *Port Denison*, the s.s. *Port Adelaide*, and the s.s. *Port Augustus*. A brief reference to the two last mentioned must suffice. The *Port Adelaide* was built by the well-known shipbuilders, Messrs. Andrew Leslie and Co., of Hebburn Quay, and was engined and boilered by Messrs. Wigham, Richardson & Co., of Walker and Wallsend. This vessel is provided with six watertight bulkheads, and is built on the three-decked principle, having, in addition, a hurricane house, 56 ft. long, as protection to the machinery, space, &c. The dimensions of the *Port Adelaide* are as follows:—Length, 332 ft.; breadth (extreme), 38 ft. 2 in.; depth of hold, 27 ft. 6 in. The gross tonnage is 2,751 tons, and the net register 1,783 tons. Although the engines are not of the triple-expansion type, they are of the highest class of ordinary compound, working at a steam pressure of 100 lbs. The cylinders are 39 in. and 75 in. diameter, with 4 ft. length of stroke. This vessel is fitted up with all the requirements for the emigration service, and has earned a good name for safe and quick passages. The *Port Augustus* is a larger steamer, and, in addition to having a longer hurricane house, has also a long topgallant forecastle. This vessel was built by the Tyne Iron Shipbuilding Company, Limited, and engined by the same firm as the *Port Adelaide*. The dimensions of the *Port Augustus* are:—Length, 347 ft.; breadth, 38 ft. 9 in.; depth of hold, 27 ft. 6 in. The gross tonnage is 2,833 tons, and the net register 1,856 tons. The engines of the latter vessel are of the latest type—triple-expansion—the cylinders being respectively 29 in., 44 in., and 74 in. diameter, with 4 ft. length of stroke, indicating 2,200 H.P. Messrs. W. Milburn & Co. also exhibit as a contrast to these modern vessels, a model of the s.s. *John Middleton*, which they describe in the official catalogue as representing the pioneer type of cargo steamers.

Messrs. Raylton, Dixon & Co., shipbuilders, Cleveland Dockyard, Middlesborough-on-Tees, although they have not the largest collection of models, have one of the most effectively arranged stands. Several of the models were previously exhibited at Liverpool, including those of the screw steamers *Africa*, *Macassar*, *Raylton Dixon*, and *Minard Castle*, of which a description will be found in our July, 1886, number, pages 106 and 107. There remains then for our present notice five models, representative of the following vessels:—H.M.S. *Tourmaline* is a composite corvette, armed with twelve guns, and fitted with engines indicating 2,100 H.P. The principal dimensions are:—Length, 250 ft.; breadth, 39 ft.; depth 23 ft.; and the tonnage 1,864 tons. H.M.S.'s *Dolphin* and *Wanderer* are composite gun vessels of the following dimensions:—Length, 165 ft.; breadth, 32 ft.: depth, 17 ft. 3 in.; and tonnage, 909 tons. Each of them are provided with 8 guns, and engines of 750 I.H.P. S.S. *Santiago* is an Atlantic liner, built to the order of Messrs. Thos. Wilson, Sons and Company, Hull. The principal dimensions are:—Length, 378 ft.; breadth, 44 ft. 6 in.; depth, 31 ft.; the gross tonnage, 4,188 tons. The engines are of the triple-expansion type, the cylinders being 31 in., 49 in., and 80 in. diameter, 54 in. length of stroke, indicating 3,300 H.P. S.S. *Haitan* is a Chinese passenger steamer, owned by the Douglas Steamship Company, of Hong Kong, of the following dimensions:—Length, 284 ft.; breadth, 35 ft.; depth, 26 ft. 3 in.; and 1,830 tons gross register. The engines are triple-expansion, 25½ in., 42 in., and 67 in. diameter of cylinders, 42 in. length of stroke, indicating 1,700 H.P. Besides models of steamers there are on Messrs. Raylton, Dixon & Co.'s stand, a number of drawings illustrative of the vessels built by this firm for Her Majesty's Navy, and as already indicated the *tout ensemble* of their exhibits is all that could be desired.

Messrs. W. Dobson & Co., shipbuilders, Low Walker-on-Tyne, occupy a stand adjoining the last mentioned, and here again we find a choice selection of models of well-designed steam vessels. Although this firm cannot compare in length of existence with several of their Tyneside rivals, it compares favourably with respect to the class of work turned out. Altogether there are six models on Messrs. W. Dobson & Co.'s stand, five of which are half models, arranged symmetrically in the back-ground, and one a full model in a glass case at the front of the stand. The latter is in some respects, the most interesting, as it represents one of four of Messrs. W. Dobson & Co.'s patent steam hoppers built for use in the Ouse improvements, for the construction of training walls, embankments, etc. The arrangement of these hoppers are of a very ingenious description, as each of the compartments for carrying slag, or other material, is divided by a longitudinal bulkhead at the centre-line. Instead of the cargo being discharged through the bottom of the hull, as is customary in the ordinary hopper, it is discharged through the sides. By this arrangement the material can be deposited in the required position with greater accuracy than in the common hopper, and this is illustrated by the model on view, which is shown laying against two piles which are driven in as a guide for the line that the embankment has to take. When the hopper is being discharged from one side, water is admitted into specially arranged tanks so

that the vessel does not take a list. The five half models represent the following steamers, several of which have much finer lines than usual, in every day practise.

The s.s. *Aire* and s.s. *Calder* are owned by the Goole Steamship Company, and are engaged in the passenger and goods trade between Goole and the Continent. These vessels are constructed of mild steel, and have a full poop, hurricane house, and topgallant forecastle. The principal dimensions are:—Length, 220 ft.; breadth, 28 ft. 6 in.; depth, moulded, 14 ft. 6 in. The engines are of the compound surface-condensing type, indicating 800 H.P., built by the North Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne, and the vessel attains an average speed of 13 knots an hour. The steel s.s. *Ouse* is a somewhat similar vessel to the last mentioned, owned by the same company, of the following dimensions:—Length, 230 ft.; breadth, 30 ft.; depth, moulded, 14 ft. 6 in. The engines are compound indicating 900 H.P., constructed by Messrs. R. and W. Hawthorn & Co., giving an average speed of 13½ knots an hour to the vessel.

The s.s. *Ardgay* is a larger vessel, engaged in the China and Mediterranean trade, belonging to Messrs. Adam Bros., of London, Newcastle, and Aberdeen. The vessel is built as a "spar decker," of the following dimensions:—Length, 250 ft.; breadth, 34 ft.; depth, moulded, 24 ft. 6 in. The *Ardgay* is constructed of mild steel, and specially fitted up for the emigrant service, and has triple-expansion engines of 850 I.H.P., built by Messrs. Black, Hawthorn & Co.

The s.s. *Bosphorus* is built of iron on Lloyd's 'three deck' rules, and is owned by Messrs. Hall Bros., of Newcastle-on-Tyne. The principal dimensions are:—Length, 305 ft.; breadth, 37 ft.; depth moulded, 25 ft. 6 in. The *Bosphorus* has a full poop, hurricane house, and topgallant forecastle, and is capable of carrying a deadweight cargo, inclusive of bunkers, of 3,400 tons, at Lloyd's freeboard. The engines, by Messrs. R. & W. Hawthorn, are compound surface condensing, and indicate 1,200 H.P. The *Bosphorus* was built in 1883, and was the first vessel constructed by Messrs. W. Dobson & Co.

The s.s. *Angerton* is built of iron and is capable of carrying 3,800 tons deadweight at Lloyd's freeboard. This steamer is owned by Messrs. Wm. Milburn & Co., of Newcastle and London, and is engaged on their Australian line, being specially fitted up for carrying 300 emigrants in the steerage, besides a number of first class passengers. The principal dimensions of the s.s. *Angerton* are:—Length, 330 ft.; breadth, 38 ft.; depth moulded, 28 ft. 6 in. The engines are on the compound principle indicating 1,500 H.P., and were built by the Wallsend Slipway Engineering Company, Limited.

Next in order, after Messrs. Wm. Dobson & Co.'s stand, comes that of Mr. J. A. Ryrie, of Station Road, Wallsend-on-Tyne. Mr. Ryrie has a very good show of steamers' models, showing the colours and anti-fouling qualities of Ryrie's Patent (Oceanic) Composition. There is also one model showing the marvellous growth of incrustation which may take place on the bottom of a vessel, not efficiently protected against the insiduous attacks of oceanic growth. A number of barnacles are also exhibited, which have been removed from the bottom of vessels, and to the inexperienced they will prove "eye openers."

Messrs. Hartman, Newman & Co., Printing Court Chambers, Newcastle-on-Tyne, have their stand in close proximity to the last mentioned. Their exhibits are all well illustrated of the now well known "Rahtjen's" anti-fouling composition for ships, bottoms, which has been used on the bottoms of most of the fastest steamers afloat. A number of models of steamers, specimens of marine growth taken off ships' bottoms, and photographs of large steamers coated in dry dock with "Rahtjen's" anti-fouling composition, are included in the exhibits of this firm, and will doubtless be examined with interest by many visitors.

The presence of a third firm's stand in the important department of British industry, of manufacturing anti-fouling compositions for home and foreign consumption, emphasizes the growing use of these now indispensable coatings for iron and steel vessels' bottoms. We refer to Messrs. M. Holzapfel and Co., of Newcastle, London, Glasgow, &c. It is largely due to the efforts of Messrs. M. Holzapfel & Co. that the quality of anti-fouling compositions was raised to the present high standard, and that this industry has assumed such large proportions. Messrs. M. Holzapfel & Co. exhibit their 'international anti-fouling paint, on a model of a steamer, as well as a supply of paint in casks and glass jars ready for immediate use. Although this composition has only been brought into use about six years ago, it now commands by far the largest sale at home and abroad. Messrs. M. Holzapfel & Co. also exhibit their genuine Rahtjen's patent composition in the same manner, and for purity of material and careful mode of manufacture, we believe they occupy the premier position among the various firms who manufacture this article. Samples of the many materials used in the making of these anti-fouling and anti-corrosive paints are also exhibited on the effectively arranged stand of Messrs. M. Holzapfel & Co., as well as other objects of interest. Amongst the numerous customers of this firm, which include the leading British, colonial, and foreign steamship companies, as well as many colonial and foreign governments, we regret, but are not surprised, that it cannot be said H.M. Government at home is included, although both the Indian and Australian authorities are regular customers. Mention must not be omitted of the *fac simile* medals that are exhibited by Messrs. M. Holzapfel and Co. on their stand, amongst which we noticed a gold medal awarded at the Crystal Palace in 1884, and a silver medal similarly received in Calcutta in 1883, in both instances the highest awards. This firm did not exhibit at the exhibition held at Liverpool last year.

Messrs. Engelbert & Co., of 70 and 71, Bishopsgate-street, London, E.C., patentees and sole manufacturers of "Engelbert's Lubricator," have a stand in the North Court, not far removed from the last mentioned, and near to the Working Dairy, in a cross passage. This lubricant has been too long and generally in use, and its important qualities have again and again been demonstrated during the last twelve years, that we need scarcely point out its great superiority over all the lower-priced oils. Although of a dark greenish colour, there is no need to fear the presence of acids or other impurities, as chemical analysis shows that "Engelbert's Lubricator" consists entirely of pure hydro-carbons, and that it is not volatile at a temperature of 600 degrees Fahrenheit. Owing to this latter quality it cannot be decomposed by high-pressure steam, a matter of extreme importance with the high speed modern triple-expansion engine. Equally important from another characteristic is "Engelbert's Lubricator." It entirely prevents scale, and leaves no deposit in the boilers, besides reducing the liability to priming, the two latter points being greatly in its favour now that the use of high-pressure steam of over 150 lbs. is so common; and the scumming off and blowing down of boilers to be seriously detrimental upon economical grounds. The non-gumming or non-clogging qualities of this lubricant should not be overlooked, nor its preservative functions when in contact with metal surfaces, india-rubber valves, &c. It does not burn on the cylinder covers, and spontaneous combustion when in contact with cotton waste and similar material is impossible. As compared with tallow or suet it is much more economical, and it lasts twice as long as the best olive oil, and is in every respect superior to any other kind of oil. It may be pointed out that to ensure the uniformity of the quality of their lubricant, Messrs. Engelbert & Co. make it their constant and regular practice never to supply intermediate parties, for the purpose of re-sale, in the United Kingdom, and the closeness of attention given to the manufacture and preparation of "Engelbert's Lubricator" for use, will doubtless lead to its being even more extensively and widely used, wherever its varied important economical and efficient qualities become known. In connection with the high-speed engines driving electric lighting machines and for the bearing parts of the latter, its use has always been found advantageous.

Messrs. MacNicoll & Co. of Glasgow, have a stand on which they display models and drawings illustrative of their specialities. A working model is shown of their patent arrangement for housing or seating anchors, as well as a working model in a glass tank, of a patent tidal ferry boat for carrying heavy traffic across tidal waters at quay level, and a design for a set of triple-expansion marine engines. The anchor housing arrangement obtained the award of a silver medal at the Inventions Exhibition, and has been in use for some time with satisfactory result in sea-going vessels, and every year there is a growing tendency to house anchors instead of heaving them on the forecastle deck. To effect this it is necessary to have stockless anchors, and greater attention is now being given to the construction of this variety of anchor. The following are stated to be the advantages of adopting Messrs. MacNicoll & Co.'s self-housing arrangement:—No blocks, ropes, or projections to foul when the anchor is ready to be let go. The forecastle deck is unencumbered and the view forward is unimpeded. The top weight is reduced, and the men working the anchors are not exposed. The anchors are quickly and easily secured without injury to the crew, and the cost is small, owing to the saving of catting and fishing gear, cranes or davits, &c.

The patent tidal ferry boat was designed by Mr. Nicoll MacNicoll, of the above-named firm, and proposed to the Clyde Navigation Trustees in response to their advertisement inviting designs for heavy traffic and cross river communication. A bronze medal, the only award for this class of exhibits; was granted for this patent ferry boat at the Liverpool Exhibition last year. The arrangement of this craft consists of a broad shallow boat, having an elevating platform balanced by a submerged pontoon, connected to it by posts sliding through trunks in the boat. The platform and pontoon are always the same distance apart, being in fact one structure, but their vertical position with reference to the boat may be shifted by chains and pulleys, screws, or other mechanical means, and retained by the use of pawls or brakes. In the model shown a central quick action screw with jam-nut has been adopted, and the adjustment of the platform with the top of the quay has been effected by making a sloped solid bottom at the side of the quay, exactly fitting the bottom of the submerged pontoon, so that hauling into place brings the top of the platform level with the top of the quay. While lying at the side of the quay the brakes or pawls are released, and the boat proper is free to rise or fall with the tide, while the platform and pontoon remain stationary. Before starting with goods or passengers the brakes are put on, and as the structure leaves the quay it slides down the inclined bottom, the boat proper sinking a few inches deeper till its increased displacement is equal to the weight of the goods or passengers on top, when the whole structure will be afloat and can be propelled or drawn to the other wharf, where it grounds on a similar bottom, and is brought up to its proper level by merely drawing into its place. By this arrangement the obstruction to navigation caused by floating landing stages and the interruption to the continuity of wharves, due to tidal slips, as well as the troublesome gradients common to both, are entirely obviated. The expense consequent upon the employment of hydraulic power is avoided, the operations, apart from the passage from wharf to wharf, being easily carried out by the ordinary deck hands. The drawing of triple-expansion engines has been designed with the view of combining efficiency, economy, and compactness, questions of great moment.

Messrs. Lishman Brothers and Bootland, Silsden, Yorkshire, exhibit a model of the after-part of a screw steamer, fitted with an improved stern and rudder post. It is claimed that by the adoption of this invention, should a rudder be damaged or lost, another one can be readily shipped without the vessel entering a port. To do this it would, in reality, require a vessel to carry a spare rudder, or the means of making one, and we fear this invention will not commend itself to practical men. It would be decidedly preferable for a steamer or sailing vessel to have on board some subsidiary arrangement of steering apparatus, after the style of a floating raft, of which we know there have been a number invented, and in some instances found on trial to be very efficient. On some other occasion we may illustrate and describe one of these inventions.

Messrs. S. & H. Morton and Co., of the Victoria Docks, Leith, have on view several exhibits, one of which will be specially interesting to many visitors. We refer to the model representing "Morton's patent slip." The one illustrated by the model is capable of hauling up steamers of 1,500 tons, and there is shown on the cradle a model of the iron screw steamer *Iberia*, so that at a glance the onlooker may understand the why and wherefore of this patent. In many instances a slipway is much more convenient and less expensive to construct than a graving or dry dock, while the actual working of the latter, when there is a pressure of repair work or sighting of the bottoms of vessels, presents practical difficulties entirely absent in a well-constructed and efficiently-maintained slipway. If two vessels are on the same dry dock, one of them may not be ready to float at the same time as the other, and the latter one has to lose valuable time. This does not occur on a slipway, as the vessel which has the heaviest repairs to do can be removed from the cradle and placed upon ordinary blocks, leaving the cradle and the slipway mechanism available for other vessels. Morton's patent slipway is no untried novelty, and, as will be seen by an inspection of the model, is arranged upon strictly mechanical principles. The screw steamer *Iberia*, represented by the model on the cradle, was built and engined by Messrs. S. & H. Morton & Co. This vessel is of the following dimensions:—Length, 254 ft.; breadth, 35 ft. 6 in.; depth of hold, 19 ft. 11½ in.; depth moulded, 22 ft. 3 in., and attains the speed of 10 knots. Messrs. Morton & Co. also exhibit the models of two other steam vessels, one of which, the *Stirling Castle*, is a well-known saloon passenger paddle steamer, designed with fine lines, and which has proved to be a fast vessel, attaining a speed of 15½ knots. The other is the screw steamer *Britannia*, a vessel 210 ft. long, 27 ft. beam, 14 ft. 6 in. depth of hold.

Wire Rope.—There is an exceptionally fine display of wire rope for rigging, hawsers, &c., as well as for colliery and other purposes, to which the pressure on our time and space prevents a lengthened notice.

Messrs. Joseph Crawhall & Sons, of St. Ann's Rope and Brattice Cloth Works, Newcastle-on-Tyne, among their exhibits have two galvanized flexible steel wire hawsers, of 2½ in. and 3 in. circumference on suitable reels, which appear to be specially adapted for the severe usage inflicted on ships' moorings.

Messrs. Haggie Bros., of Gateshead, have a very imposing display of wire ropes, and specialities in connection with their use. Around the stand of this firm will be seen a galvanized steel hawser or slipway rope of 9 in. circumference, having a breaking strain of 250 tons, and they also exhibit special flexible steel wire ropes and warps for ships' use, as well as Archer's patent nipper.

Messrs. George Cradock & Co., of Wakefield, have a pyramid of wire ropes attracting the attention of the visitor, while to those interested in shipping they show two steel hawsers, a 3½ in. one on a brake reel, and a 2½ in. one on a store reel. The arrangement of the brake on the former is an improvement upon those often fitted, being easily manipulated by hand, and certain in its action. They also exhibit Harfield's patent stopper for steel wire hawsers.

Messrs. R. S. Newall & Co., and Messrs. Dixon & Corbitt, of the Teams Rope Works, Gateshead, have, since they entered their names as exhibitors, combined their businesses into one firm, and they have undoubtedly the largest and most important display in wire, manilla, and other ropes. The flexible steel wire rope for hawsers, trawl warps, running rigging, &c., including braces, is made with an improved compound twist, so that the rope is not only more flexible, but is less liable to kink.

Amongst other exhibits of more general interest we noticed the model of the ship *William Connell*, and which was the first vessel ever riggged with wire rope, as well as a large number of samples of submarine telegraph cables, including the ill-fated 1857 Atlantic one.

Messrs. George Elliot and Co., 23, Great George Street, Westminster, London, have also a very large and effective display of wire ropes of every description, including galvanized steel wire hawsers, but many of their exhibits are of greater interest to mining than marine engineers, shipbuilders, or shipowners.

Messrs. R. Hood, Haggie & Son, Willington Patent Rope Works, Newcastle-upon-Tyne, have a large and varied collection of ropes of all kinds, steel wire, galvanized iron, manilla, hemp, sisal, &c., as well as copper lightning conductors, all of which we cannot for want of space particularise. Several of their exhibits attracted our special notice, more especially the splendidly finished galvanized flexible steel hawsers on wrought iron reels, equipped with appliances for mooring vessels to bollards on shore, with steel strops. The 90 fathom 4½ in. galvanized flexible steel towline on a very strongly constructed winch, with a 15 in. coir rope attached to give elasticity also evoked our praise. It may be remarked that the 15 in. coir rope just equals in strength the 4½ in. steel wire hawser, and also that the winch on which the hawser was ruled has a very effective frictional strap break actuated by a foot-pedal, so that the man at the winch has both his hands at liberty, and can easily control the efficient paying out of the hawser. The white and tarred manilla ropes for towlines, warps, running gear, &c., are of the very best kind, and reliance can be placed upon the shipowner obtaining from this firm the special article they order. Sisal rope, which is so much cheaper than manilla, is sold as sisal, and manilla ropes are not manufactured partly of sisal, nor are foreign substances introduced into the core of the manilla ropes to make them heavier, as occurs when ropes are bought from firms of no standing. The most important among the many exhibits of this firm is the 6½ in. flexible steel rope, having a breaking strain of 130 tons. This is specially recommended for use in checking vessels at the time of launching, a practise which should be much more in vogue than it is at present. Shipowners should, however, insist that shipbuilders should provide themselves with proper tackling for controlling the vessel on the day of launching and until delivery, and especially prohibit the use of the vessels' cables for the purpose of overcoming the impetus given to the hull of their vessels at their launch. The 6½ in. flexible steel wire rope just alluded to is provided with a 25 in. coir spring to give the required elasticity, and this rope is also suited for the heaviest descriptions of towing, &c.

THE MACHINERY OF SMALL BOATS FOR SHIPS OF WAR.*

By A. SPYER, Esq., Member.

THE object of this paper is to draw attention to the important advances which have been made of recent years in the design and construction of the machinery fitted in the small boats carried by ships of war. Prior to 1879 all these boats were fitted with high pressure machinery; since that date, however, great improvements have been introduced from all points of view, resulting in a large reduction in the weight of the machinery, with at the same time a great gain in coal economy. The three most important factors in the progress here recorded have been (1) the application of the surface condenser; (2) the compounding of the engine; (3) the adoption of forced draught for the boilers.

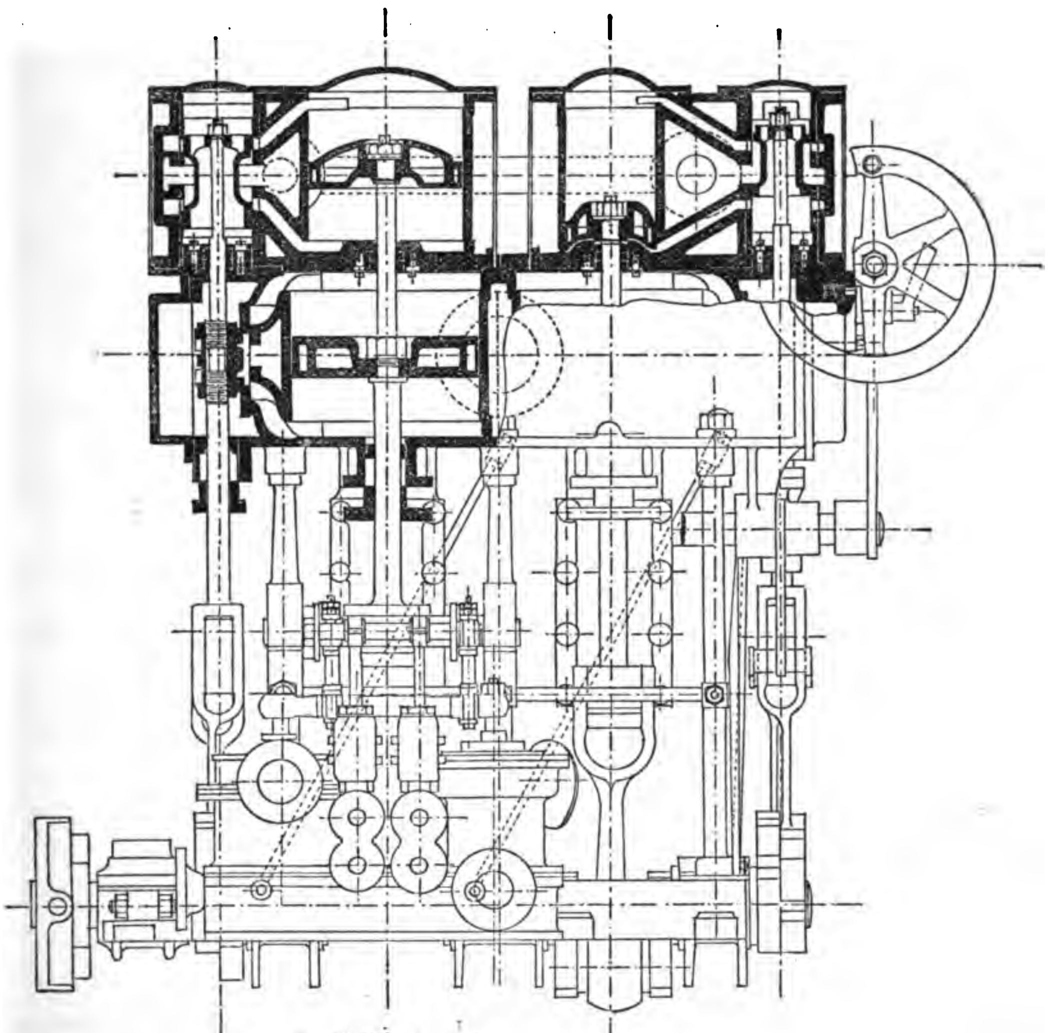
The first steamboat for naval purposes was a little vessel called the *Experiment*, built and engined at H.M. Dockyard, Portsmouth, and tried in 1863, and subsequently, in 1864, these small crafts made their appearance on ship-board in the form of what is now known as the steam launch. These were 42 ft. in length, and fitted with twin-screw high-pressure engines, the boiler being of the locomotive type; each screw was driven by a two-cylinder engine bolted on to the flat sides of the boiler, and the speed attained was from 6 to 6½ knots, with about 25 I.H.P.

These boats were to all intents and purposes rowing launches converted, and the speed obtained were by comparison very satisfactory.

The exigencies of naval service, however, soon caused a rapid development in steamboats, and they shortly became differentiated into three leading classes, termed respectively launches, pinnaces, and cutters. This classification was somewhat arbitrary at first, as regards the description of steam power applied, the differences being mainly one of size; but in recent times distinctive characteristics have developed in the machinery of each of these classes, owing to the character of the boats and the nature of the service on which they are employed, and it will therefore be convenient to adopt the same classification and nomenclature.

Triple Expansion Launch Engine.

Fig. A.



Scale 1" = One foot.

* *Read at the Twenty-eighth Session of the Institution of Naval Architects.*

The efforts made at the Admiralty from time to time to obtain improved types of boats and machinery have been readily responded to by many able private firms. Amongst these, Mr. John Samuel White, of Cowes, in conjunction with his engineers, Messrs. G. E. Belliss & Co., of Birmingham, has been especially successful in coping with the difficulties to be overcome; and to the ability of these gentlemen is due, not only many improvements in detail, but the initiation of several novel types.

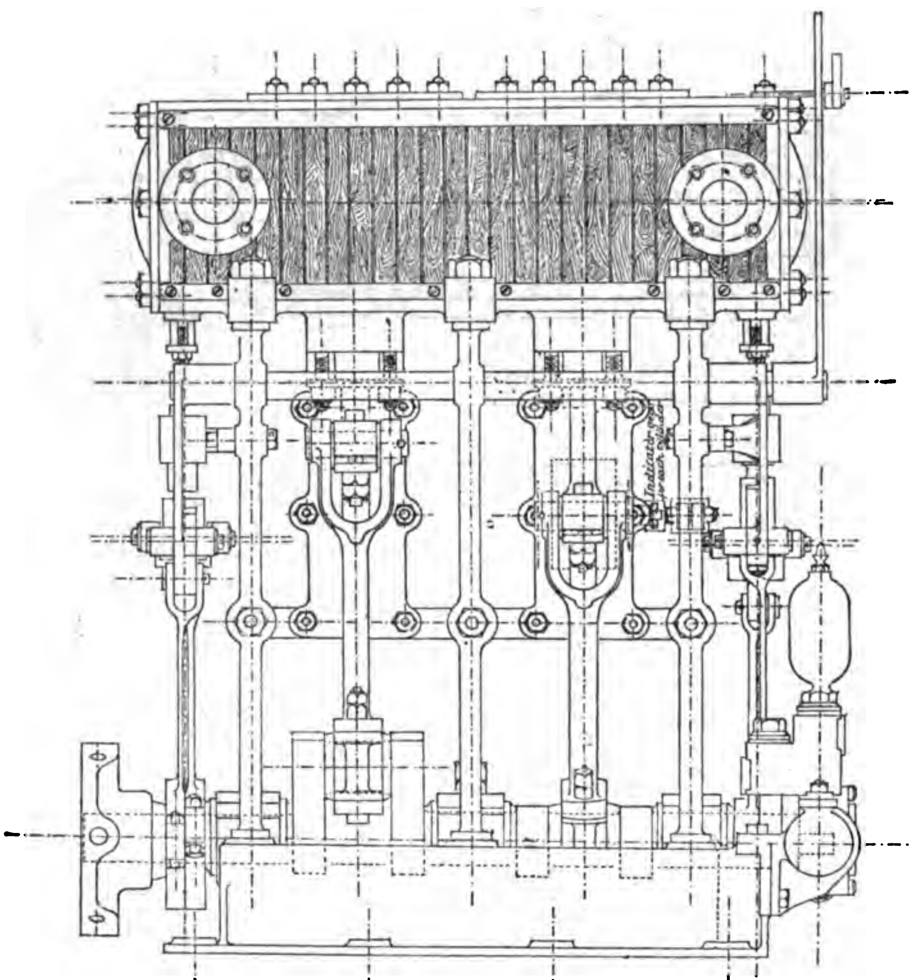
After this, until 1878, the performance of the machinery of this class of boat remained nearly stationary, no important improvements being attempted.

Two representative cases (Nos. 1 and 2) are given in the tables, showing the results of the trials and the particulars of the machinery at this date (1878). One of these boats is fitted with a locomotive boiler, and the other with a direct tube boiler of the pinnace type, which has been adopted in some cases on account of

SIMPLE ENGINES FOR

37FT PINNACE

Fig. B.



Scale 1½ - One Foot.

the greater facilities for cleaning, &c.; but the engines of both were of the same twin screw high pressure description.

Dealing first with launch machinery, it will be seen from the accompanying figures that considerable progress was made in the years immediately following 1864:—

Date.	Length of Boat.	I.H.P.	Speed. Knots.
1864	42·0	25	6·57
1866	42·0	43	7·71
1868	42·0	46	8·43

In 1879 an endeavour was made to improve the performance of the 42-ft. launch by increasing the power; no success resulted therefrom, however, as though the I.H.P. was nearly doubled the speed remained practically the same. The particulars of this experiment are given in the tables, case 3. In the later launches for harbour service, the form of hull has been modified and length increased with a better result, the speed attained with a 5-2ft. launch being 8·83 knots. This is illustrated by Example 4.

It should be remarked that the forms of these boats were not intended, or adapted for speed, and they were being rapidly replaced on board ship by the pinnaces and cutters then coming into use, the scope for the steam launch becoming gradually con-

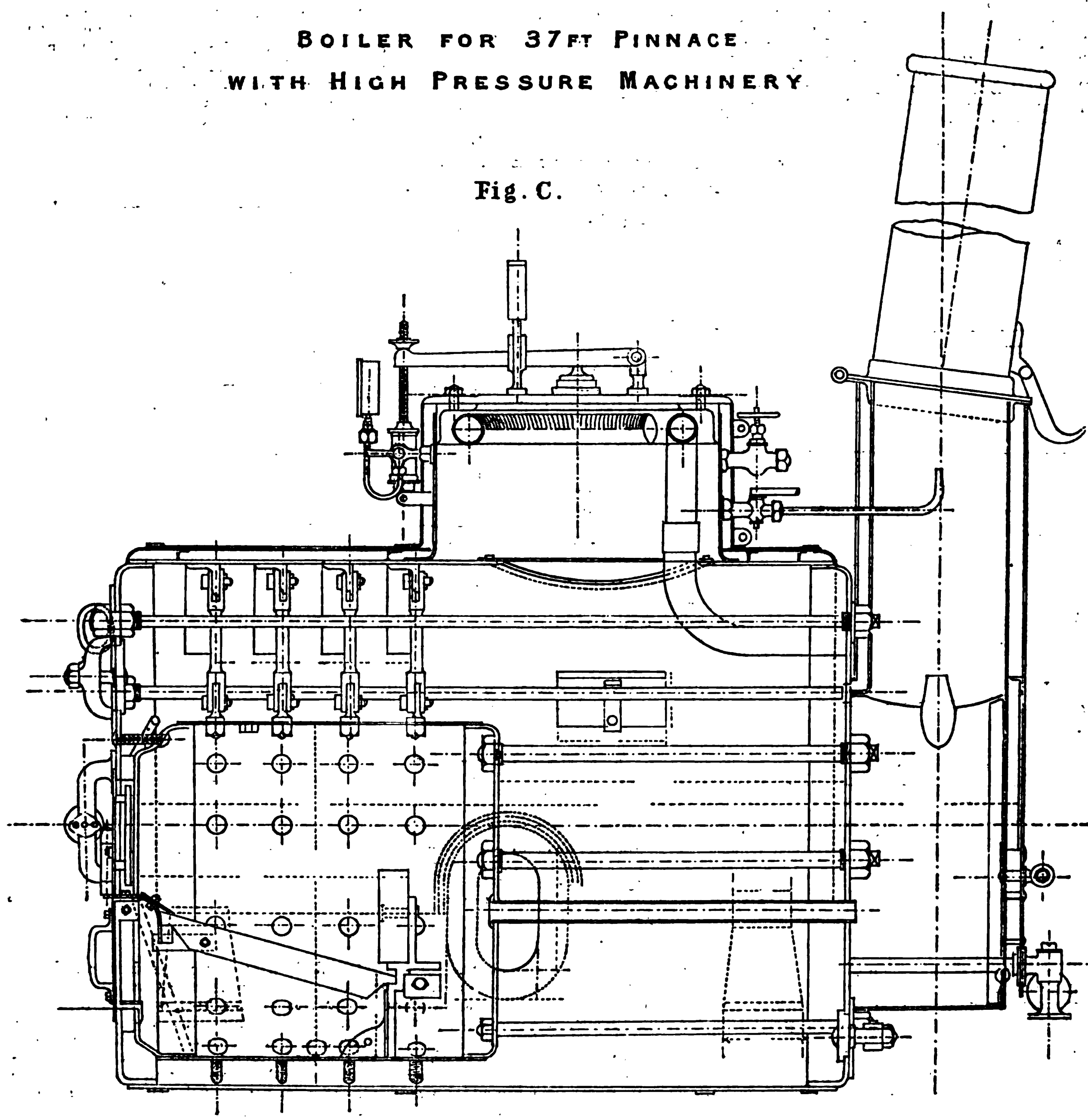
fined to coast and harbour service for transporting, towing, submarine mining, &c.

In a recent case, and as a consequence of the duty for which the boat was to be utilized, attention was directed to the production of an economical coal-burning engine, and with that object in view, a launch intended for service in Plymouth and to be in constant use was provided with triple-expansion machinery.

limited length available in the boat, which would not allow of a three-crank engine. The piston and valve rods pass through internal metallic glands to reduce the height as much as possible; piston valves are used for the high and intermediate slides, and ordinary valves for the low pressure; no reservoirs are provided beyond the necessary steam passages. There is a surface condenser of copper with brass tubes, and the pumps are driven off

BOILER FOR 37FT PINNACE WITH HIGH PRESSURE MACHINERY

Fig. C.



Scale 1"-One Foot.

The boiler in this case is of the ordinary cylindrical return tube type, with one circular furnace; it is constructed entirely of steel, and loaded to 140 lbs. on the safety valves. Single screw engines are adopted, with two cranks; there are two low pressure cylinders, the high and intermediate cylinders being placed on the top of the low pressure cylinders. This design of engine was resorted to, not as the best for triple-expansion, but on account of the

the piston rod crosshead of the after-engine. These engines are illustrated in Diagram A.

The particulars of this machinery and the results of the recent trials at Plymouth are given in the tables, Example 5; the coal consumption was measured, and on a three hours' trial, with the steam jet in use occasionally, was found to be 2·54 lbs. per I.H.P per hour, a result which, for machinery on so small a scale, and

under these circumstances, may be considered to be a good one. The weight of the machinery is comparatively high, but this is mainly due to the type of boiler adopted.

In this instance the advantages obtainable in economy by the use of the triple-expansion engine were of sufficient importance to compensate for the somewhat additional complication and the slight extra first cost involved. The adoption of this type of machinery is, however, in a great measure dependent on the nature of the service for which the boats are to be utilized; and as these small craft are frequently employed on detached duty away from their ships, the quantity of coal to be carried is a matter of considerable importance. Coal-boxes are provided in all boats, but the endurance is really limited by the extra quantity that can be carried in bags, and any reduction in this would allow of a corresponding increase in stores, armament, or in the number of the crew.

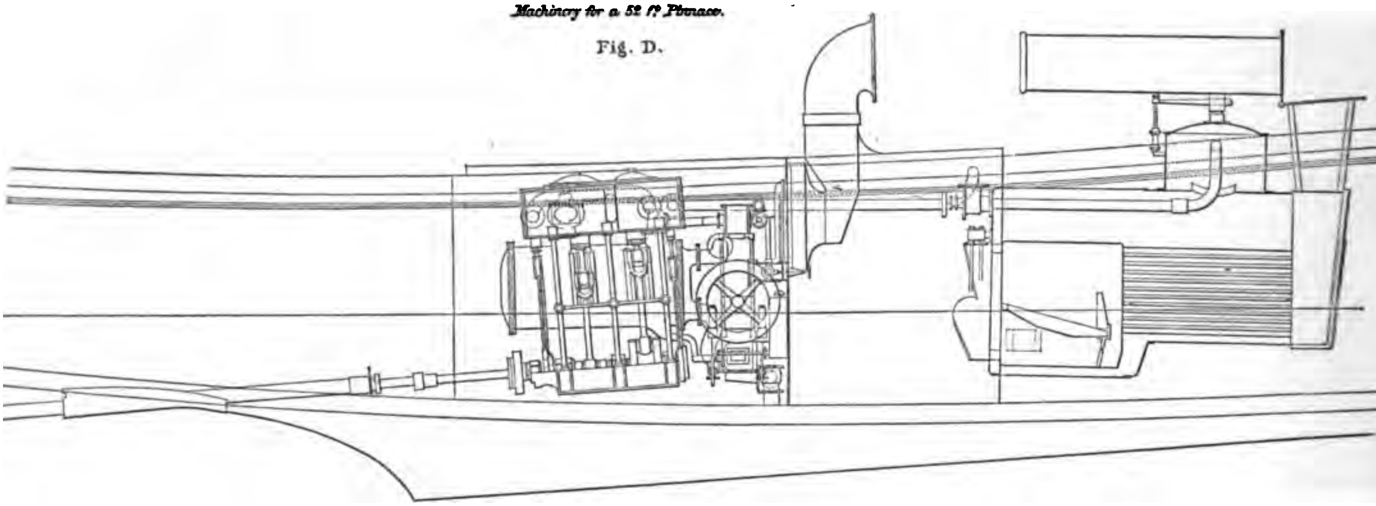
The machinery in all these boats is of the same type, and the leading particulars of the 37 ft. pinnace engine are given in the tables, Example 6, and illustrated in Diagrams B and C.

In this machinery the boiler is of the direct tube horizontal cylindrical type, entirely of steel, but with tubes usually of brass, and is intended to carry a load of 70 lbs. per square inch on the safety valves. The shells are $\frac{5}{16}$ thick, being made thicker than required for the working pressure, on account of the external corrosion found to take place at the bottom of the shells. The fire-bars are of wrought iron, and so secured that they cannot be thrown out of place by any shock or jerk. A cock is al-o fitted on the boiler, so that it may in case of need be filled with hot water or steam from the main boilers of the ship. A silent blast tank of copper, and water tanks of the same material, carrying about 80 gallons of water, are fitted in the air-tight casings of the boat.

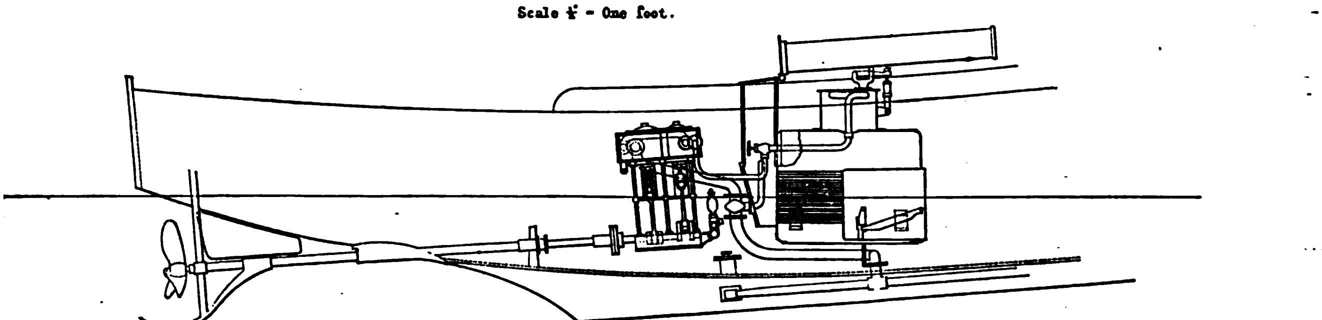
COMPOUND SURFACE CONDENSING FORCED DRAFT.

Machinery for a 52 ft Pinnace.

Fig. D.



Scale ¼" = One foot.



COMPOUND SURFACE CONDENSING NATURAL DRAFT,

Machinery for 28 ft Cutter.

Fig. F.

Shortly after the adoption of the steam launch as a portion of the boat complement of war-ships, the steam pinnace was introduced: this class of boat is of finer form than the steam launch, and has been in most cases propelled by a single screw. After a few variations in the first instance, the steam pinnace, prior to 1880, had been built in four leading sizes, the principal features of which were as follows, in representative cases:—

Length of Boat.	I.H.P.	Speed Knots.
30·0	24	7·6
37·0	38	8·2
42·0	47	9·04
45·0	47	9·83

The "silent blast" tank is a copper vessel into which the exhaust steam from the engines is delivered, a separate pipe leading away from this tank into the funnel, with a nozzle on its extremity to produce the funnel draught. The effect of the introduction of this tank into the path of the exhaust steam is similar to that of an air vessel on a pump; it produces a comparatively steady flow of steam into the funnel, and avoids the noise which would otherwise be produced by the jets of exhaust steam passing there direct. The mean pressure of steam in this tank when running full power is from 3 to 3½ lbs.

The propeller is single, of gun-metal, and driven by two cylinders carried on steel columns; the covers of the cylinders and valve chests are of sheet steel pressed into shape. There are two gun-metal feed pumps driven off the end of the shaft: a small steam donkey pump, which can be used as a hand pump, is also fitted.

The total weight of the engines only is 9 cwt., and they will develop up to 40 I.H.P. at the revolutions and steam pressure usually given.

In 1879, however, in consequence of the demand for increased speed, a very important development was effected; the boiler

was placed under forced draught, and compound surface condensing engines fitted; the boat was modified to suit these conditions, and the length increased to 48 ft.

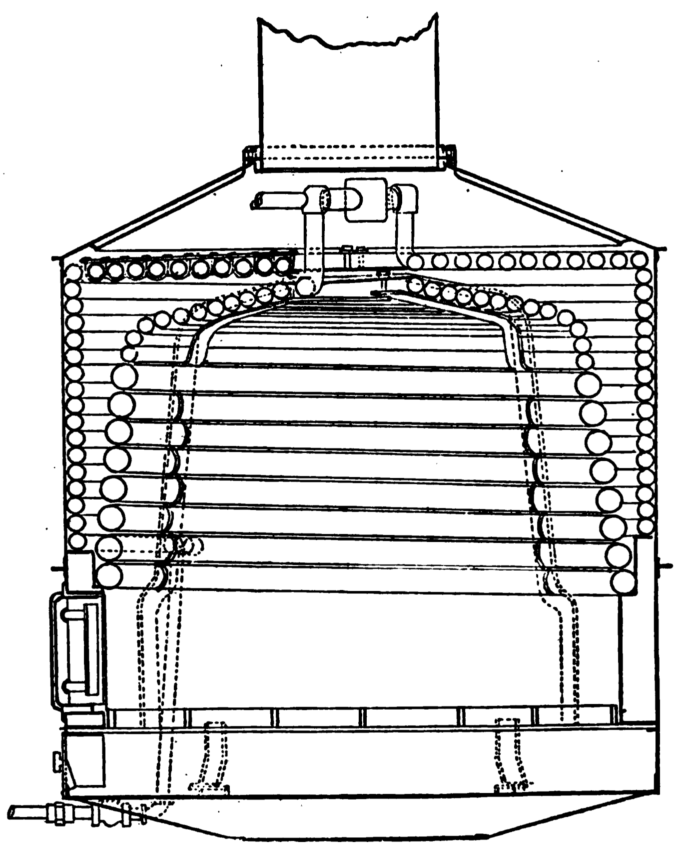
In the first instance the boiler was of the pinnace type already described, but loaded to 120 lbs. pressure, with dimensions suitably modified for the increased I.H.P.; the air pressure was obtained by a fan and separate engine in the stokehole; the engine was compound, with an internal surface condenser, and the pumps were worked off the engine shaft.

probably from the superior propulsive efficiency of the two screws. The usual Admiralty displacement co-efficients are also given, but it should be remarked that in these small boats the variation for displacement is probably more nearly in the direct ratio than the 2-3rd power. The twin-screw arrangement is, however, in many respects not so convenient for these boats as the single screw.

It will be seen that in going from the high pressure machinery in the 37 ft. pinnace to the compound forced draught machinery in the 48 ft. boat, the weight was reduced from 1·66 cwt. to 0·9 cwt.

HERRESHOFF COIL BOILER

Fig. E.



Two such boats, 48 ft. long, were tried in 1880, one being fitted with twin-screws, the other with a single screw. The results were as follows:—

	Date of trial.	Pressure of Steam.	Revolutions.	I.H.P.	Speed.	Displacement.	$\frac{D^{\frac{2}{3}} V^3}{I.H.P.}$
				Knots.	Knots.	Tons.	
Single Screw	9·3·'80	119·8	304·8	103·9	12·01	13·55	94·93
Twin Screw	11·2·'80	118·5	342·6	121·2	13·39	10·73	96·43

The particulars of the twin-screw boat are given in the tables, example 7.

It is of interest to note here that an advantage in point of performance was shown by the twin-screw pinnace, this resulting per I.H.P., whilst the I.H.P. developed per square foot of grate surface had increased from $10\frac{1}{2}$ to 20, the speed going up at the same time about 3 knots compared with the fastest high-pressure boat previously in existence. A great gain in economy of fuel had been at the same time effected. In a trial made in 1880, to test the coal consumption, the following result was obtained:—

48 ft. Twin Screw Pinnace.

I.H.P.	Coals per I.H.P. per hour.	Coals per Square Foot of Grate per Hour.
	Lbs.	Lbs.
123	3·19	70·3

This would be about half the coal per I.H.P. consumed in t high-pressure boats.

TABLE I.—PARTICULARS OF MACHINERY.

	Distinguishing Number.	Length of Boat.	Description of Machinery.	Cylinders. Diameter.	Cylinders. Stroke.	Propeller. Description.	Propeller. Diameter.	Propeller. Pitch.	Boiler. Description.	Boiler. Grate Surface.	Boiler. Tube Surface.	Boiler. Load on Valves.	Ratios. Tube Surface / Grate Surface.	Ratios. Tube Area / Grate Area.	Total Weight of Machinery.
		ft. in.			Inches.		Ft. in.	Ft. in.		Sq. ft.	Sq. ft.	lbs. per sq. in.			Cwts
Launches.	1	42 0	High pressure	4 of 5⅜ in.	6	Twin 4 blades	2 6	3 10	Locomotive	4·65	76·0	80	16·3	6·8	77
	2	42 0	Do.	4 of 5¼ in.	6	Do.	2 9	3 4½	Horizontal Direct	3·75	126·0	80	33·6	2·9	72
	3	42 0	Do.	4 of 6 in.	6	Do.	2 9	3 3¼	Locomotive	5·25	121·0	104	23·0	·6	85
	4	52 0	Do.	4 of 6 in.	6	Do.	2 5⅜	3 4½	Do.	5·66	179·0	70	31·5	5·3	115
	5	50 0	Triple Expansion	1 of 6 in., 1 of 10 in., 2 of 12 in.	8	Single, 3 blades	3 6	4 1⅞	Cylindrical, return tubes	10·0	180·0	140	18·0	6·7	179
Pinnaces.	6	37 0	High pressure	2 of 6⅜ in.	6	Single, 3 blades	2 9½	3 7½	Horizontal Direct	3·6	124·0	70	34·3	2·2	63
	7	48 0	Compound Surface Condensing	2 of 7½ in., 2 of 11¼ in.	8	Twin, 4 blades	3 2¾	4 7⅜	Do. forced draught	5·65	200·0	120	35·4	4·3	109
	8	48 0	Do.	1 of 7⅝ in., 1 of 11⅝ in.	8	Single, 3 blades	2 10	3 8¾	Locomotive, wet fire-box	5·0	180·5	120	36·0	4·5	75
	9	52 0	Do.	1 of 8½ in., 1 of 13in.	9	Do.	3 1	3 11¼	Do.	5·4	205·0	120	37·9	4·0	106
	10	48 0	Do. (Herreshoff)	1 of 8 in., 1 of 14 in.	9	Single, 4 blades	3 0	4 1	Coil	12·3	149·7	150	12·4	...	...
Cutters.	11	25 0	High pressure	2 of 4 in.	5	Single, 3 blades	2 3	2 6¾	Horizontal Direct	1·25	40·1	70	32·0	2·3	25
	12	30 0	Do.	2 of 4¾ in.	5	Do. 4 do.	2 6½	2 2	Do.	1·77	64·5	70	36·3	2·1	33
	13	30 0	Compound (Kingdon system)	2 of 3 in., 2 of 6¼ in.	5⅝	Do. 3 do.	2 1⅝	3 $7\frac{3}{16}$	Vertical	5·0	196·5	100	39·2	3·8	39
	14	30 0	Compound (ordinary system)	1 of 4½ in., 1 of 7¼ in.	5	Do. 3 do.	2 2¾	2 3½	Horizontal Direct	2·83	77·5	120	27·3	3·0	40
	15	25 0	Do.	1 of 4 in., 1 of 8 in.	5	Do. 4 do.	1 11¾	2 8	Do.	2·3	68·5	120	29·6	2·7	32
	16	28 0	Do.	1 of 4 in., 1 of 7 in.	5	Do. 3 do.	2 2½	2 5	Do.	2·63	48·4	120	18·4	4·8	27

NOTE.—The weights given above include the water in boilers and condensers and the weight of tanks, spare gear, &c., but not the water carried in the tanks.

TABLE II.—PARTICULARS OF TRIALS.

	Distinguishing Number.	Length of Boat.	Date of Trial.	Nature of Trial.	Pressure of Steam in Boiler.	Mean Pressure in Cylinders.	Revolutions. Mean.	I.H.P. Total.	Coals per I.H.P. per Hour.	Speed.	I.H.P. per sq. ft. of Grate.	
		Ft. in.			Lbs.	Lbs.			Lbs.	Knots.		
Launches.	1	42 0	4.6.78	Measured mile	76.5	44.7	307.0	42.0	—	7.74	9.0	High pressure machinery with locomotive boiler.
	2	42 0	7.6.79	Do.	71.1	55.17	292.3	42.3	—	8.33	11.2	High pressure machinery with horizontal boiler.
	3	42 0	30.9.79	Do.	102.0	65.18	400.2	75.0	—	8.30	14.3	Do. with locomotive boiler and increased power.
	4	52 0	23.7.85	Do.	73.1	52.20	360.9	64.6	—	8.83	11.5	Do. with locomotive boiler and increased length of boat.
	5	50 0	9.2.87	Do. & 3 hours	139.1	H. 51.1 I. 36.9 L. 10.5	283.4	70.8	2.54	9.26	7.1	Triple-expansion engines.
Pinnaces.	6	37 0	9.11.85	Measured mile	77.0	62.8	311.6	37.9	—	8.27	10.4	High pressure machinery.
	8	48 0	4.11.85	Do. & 2 hours	130.0	High. 56.7 Low. 23.7	427.5	85.3	—	11.89	17.0	Compound forced draught and locomotive wet firebox boiler.
	9	52 0	24.8.86	Measured mile	120.0	47.3 25.6	485.1	134	—	15.03	24.8	Do. Do.
	7	48 0	2.8.81	Do.	125.0	— —	301.1	—	—	12.60	—	Do. Do. horizontal direct boiler.
	7	48 0	4.8.81	5½ hours	104.8	44.2 16.2	246.3	68.8	3.17	10.18	—	Do. Do.
	7	48 0	3.8.81	10 8/60 hours	55.5	16.1 6.95	163.5	18.3	4.9	7.40	—	Do. Do.
	10	48 0	2.8.81	Measured mile	145.0	— —	453.0	—	—	15.12	—	Do. Do. Herreshoff boiler.
	10	48 0	4.8.81	5½ hours	93.1	53.1 12.0	333.0	68.4	4.13	10.18	—	Do. Do.
	10	48 0	3.8.81	8 44/60 hours	52.3	34.2 8.02	273.2	36.7	3.88	8.63	—	Do. Do.
Cutters.	11	25 0	2.9.85	Measured mile	74.6	57.8	408.1	14.97	—	7.02	12.0	High pressure machinery with horizontal direct boiler.
	12	30 0	27.7.85	Do.	75.83	55.8	400.1	20.0	—	7.63	11.3	Do. Do.
	15	25 0	17.12.84	Do.	120.0	H. 61.8 L. 18.1	471.8	20.1	—	6.98	8.7	Compound natural draught machinery, horizontal direct boiler.
	13	30 0	2.12.84	Do.	107.3	68.2 20.4	363.9	22.9	—	7.47	4.6	Do. Do. Kingdon boiler.
	14	30 0	13.11.84	Do.	120.8	74.8 21.8	442.0	23.3	—	7.86	8.1	Do. Do. horizontal direct boiler.
	14	30 0	1.12.84	4 hours	110.6	36.9 7.1	265.7	5.9	4.04	5.9	—	Do. Do. Trials to test coal consumption.
	13	30 0	1.12.84	Do.	75.0	20.6	273.2	5.1	7.25		—	Do. Do.
	16	28 0	5.7.86	Measured mile	125.0	75.2 23.4	434.3	20.2	—	7.73	7.7	Do.

Latterly these fast pinnaces have been constructed in three classes, the leading features of which are as follows:—

Length of Boat.	I.H.P.	Speed. Knots.	Weight of Machinery. Cwts.
48·0	85	11¾	75
52·0	125	14½	106
56·0	150	15·0	129

The machinery, as fitted in these boats, comprises many new features introduced since the first pinnaces were tried in 1880.

The boiler, after one or two intermediate stages, has developed into what is now known as the wet firebox locomotive type; it is constructed of steel, with tubes usually of brass, the firebox and dome being of Lowmore iron. It is placed in the boat in a separate compartment, with a fan and engine for producing the air pressure. Single screw compound engines have been adopted, with two cylinders supported on steel columns with diagonal bracing; the condenser is internal, of copper, with brass tubes; the air feed and circulating pumps are driven by a separate compound engine, running about 80 revolutions per minute when the main engines are at full speed. A system of piping is provided, to enable the engines to exhaust directly overboard in the event of accident to the pumps or condenser; and separate piping is provided so that the circulating pump may draw from the bilge and discharge directly overboard in case of a leak. A "silent blow-off" is also fitted to pass steam into the condenser from the boiler, thus avoiding the noise of steam escaping from the safety valves and the loss of fresh water. With the separate pumping engines provided the full head of steam can thus be maintained independently of the movements of the main engines.

The leading results now obtained in the 48 ft. and 52 ft. pinnace are given in the tables, cases 8 and 9. It will be seen that the improvements introduced have reduced the weight to ·79 cwt. per I.H.P., the I.H.P. developed per square foot of grate being 24·8. The general arrangement of the machinery in a 52 ft. boat is shown on diagram D.

The Herreshoff system as applied to small boats had in the meantime attracted much attention, and in 1881 two 48 ft. pinnaces, built and engined by the Herreshoff Company, were introduced and tried.

These boats were provided with single screw compound engines, and a surface condenser in the shape of a copper pipe outside the boat, and they were fitted with the coil boiler identified with the name of Mr. Herreshoff, all the machinery being contained in one compartment, with a fan for producing the air pressure.

The Herreshoff boiler consists of a continuous coil of piping, of increasing diameter towards the lower end, and arranged in the shape of a hive, this coil being placed above the firegrate and the whole surrounded by a second coil of piping. The feed-water enters at the bottom of the external coil and ascends, passing downwards through the inner coil, from the bottom of which the mixture of steam and water is delivered into a separator, whence the steam is supplied to the engines, the water being again pumped back into the boiler. The elevation of the boiler showing the general arrangement is shown on diagram E.

A series of trials was made in 1881 in one of these boats to ascertain the performances as to speed and coal consumption; similar data being also obtained for one of the fast pinnaces with ordinary compound machinery, the boat selected for comparison being the twin-screw pinnace already alluded to in case 7.

The particulars of these trials and the dimensions of the machinery in these two boats are given in the tables, cases 7 and 10. Three sets of trials were made—the first on the measured mile, to test the full speed; the second, a time trial to test the coal consumption, with both boats running at the same speed; and the third, both boats running their best, with natural draught only, and 10 cwt. of coal on board.

The result of the first series showed a considerable advantage in favour of the Herreshoff boat, the speeds being respectively 13·19 and 12·6 knots; the second series showed an advantage in favour of the ordinary machinery, the coal consumption per I.H.P. being 30 per cent. greater with the Herreshoff boiler. On the third series, the Herreshoff boat, after 8⅔ minutes, had burnt all her coal, and had travelled over 72·5 knots, or 7¼ knots per cwt.; in the other pinnace the trial was stopped after $10\frac{1}{30}$ on account of darkness setting in; she had then steamed 75 knots, and still had 258 lbs. of coal left on board, being at the rate of 9·6 knots per cwt. The performance was however at a lower rate of speed, and the consumption per I.H.P. was greater.

No doubt a most important fact in the high results obtained as to speed in the Herreshoff boat is the light weight of the machinery, which is principally due to the boiler. In this instance there was no record of the weight but at a somewhat later period two small pinnaces manufactured by the Herreshoff Company were tried; these boats were 33 ft. in length, and would compare most nearly with the 30 ft. naval service cutter for general purposes, and a trial was therefore made with one of them, in comparison with such a boat; the Herreshoff pinnace had compound machinery and a single-coil boiler, the Service cutter at that time having high pressure machinery of the usual type.

The results obtained were as follows, no indicator diagrams were however taken on these trials:—

	Herreshoff Pinnace 33 ft.	Service Cutter, 30 ft.
Pressure of Steam in boiler ..	122	74
Revolutions	305·3	457·1
Speed	8·073	7·695
Cylinders	4½" and 7' / 7"	(2) 4½" / 5"
Total Weight of Machinery ..	19 cwt.	33 cwt.

A trial was also made in the Herreshoff pinnace with the boiler loaded to 180 lbs. per square inch and only four persons on board, and a speed of 9·25 knots was then obtained with about 400 revolutions.

The difference in the weight of machinery is very marked, and lies almost entirely in the boilers and water contained, these weighing respectively 10¼ and 22 cwts.; in this case however the boiler is of the single coil type and would be somewhat lighter proportionately than the double coil boiler fitted in the larger pinnace.

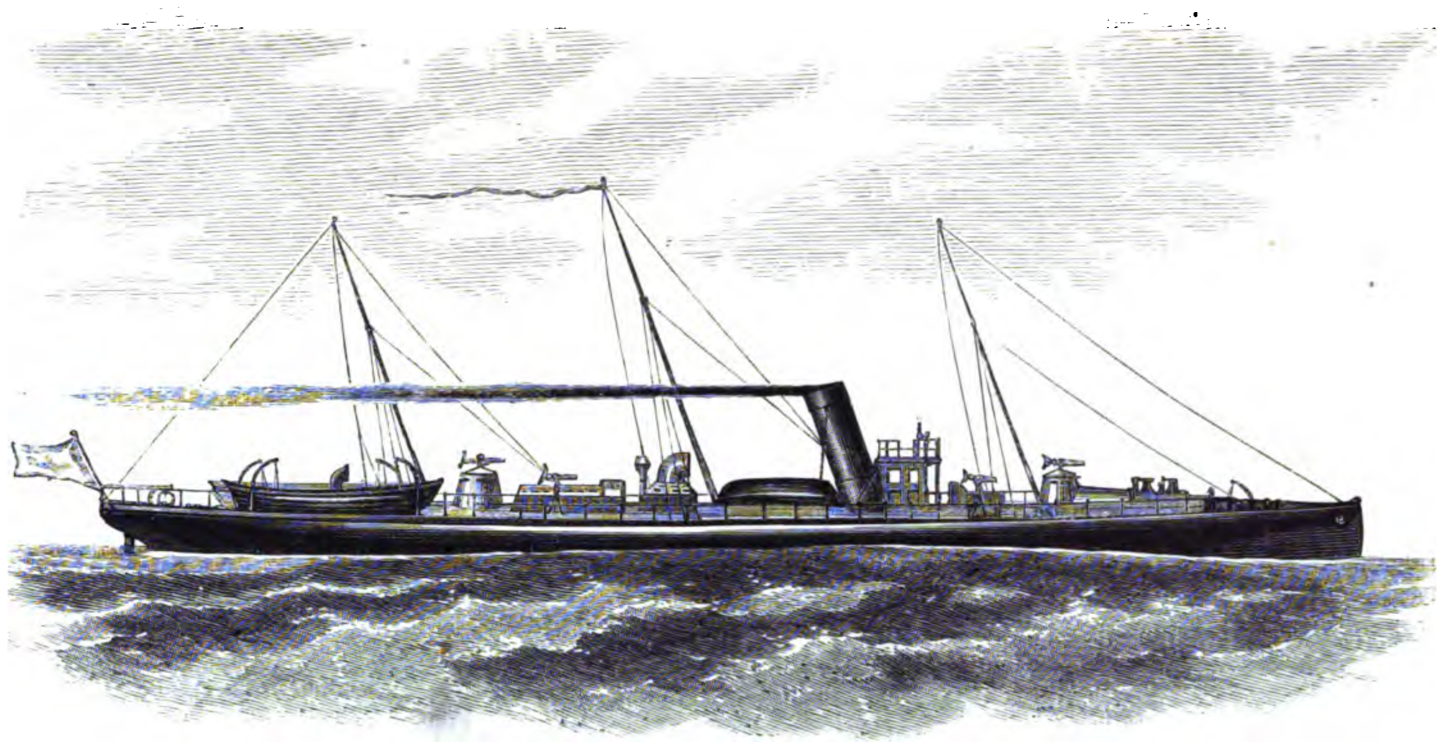
The very small quantity of water contained in these coil boilers enables steam to be raised very rapidly; with the double coil boiler on the 48 ft. pinnace mentioned the experiment was tried, the steam was raised to 60 lbs. from cold water in 5 min. 50 sec. Another result, however, of this small quantity of water is that most careful firing is required in order to maintain a reasonably steady steam pressure; it is moreover found that on actual service this description of boiler wears out very rapidly.

The machinery of the third class of these small craft, the steam cutter, may fairly be said to have made advances quite comparable to those attained in either of the other two. These boats are the smallest in size, and did not appear in any number until 1874; they varied in length from 21 to 30 ft., and attained speeds of from 6¼ to 7 knots, developing 10 to 15 I.H.P. The smaller sizes were usually fitted with single cylinder, the larger with two-cylinder engines; the boilers being of the high pressure pinnace type before described.

Latterly two-cylinder engines have been applied to all, the two leading sizes being those fitted in the 25 and 30 ft. cutters, the particulars of which are given in the tables, cases 11 and 12; the machinery is of the same high pressure type as that previously described for the pinnaces, except that water tanks are not fitted, as it is not possible in these small boats to carry sufficient to be of any practical service.

As a consequence the boilers in these boats salted up very rapidly when used in sea water, and the importance of fitting a surface condenser was strongly apparent.

In 1883 a step in this direction was made by the introduction of two boats fitted with compound surface-condensing machinery by Messrs. Simpson & Denison, on the "Kingdon" system. This machinery is of a special type; the engine is compound, with two cranks and four cylinders, one high and one low pressure cylinder to each crank, the high pressure cylinders being on the top of the low; the condenser is of the external type, fitted close into the keel; the boiler is cylindrical and vertical, with vertical tubes of small diameter, and is usually worked with



LIGHT TORPEDO CRUISER, OR TORPEDO DIVISION BOAT.

CONSTRUCTED BY HERR SCHICHAU, ELBING.

(For Description see page 97.)

natural draught. The pumps are driven direct from the piston-rod crossheads.

In 1884 several boats fitted with natural draught surface-condensing compound machinery were introduced and tried. The machinery of some of these was of the ordinary type, the grate surface of the boilers being increased in order to compensate for the feeble natural draught, the tubes also being shortened in length, reduced in diameter, and increased in number. In most cases the outside condenser was adopted, this plan being light, efficient, and very simple, though more liable to injury from grounding. The particulars of the machinery of some of these, and the performances on the trials, are given in the tables in Cases 13, 14, and 15. The results obtained made it clear that the compound condensing machinery with no forcing beyond that of a small steam jet in the funnel used occasionally, could be produced, even on these small dimensions, for practically the same weight as the high pressure engine with the exhaust blast; the fresh water for the boiler was saved, a great economy of fuel was effected, the firing in consequence of the large grate surface was much easier, and the noise and white cloud of steam occasioned by the exhaust blast was avoided.

To test the coal economy a series of trials was made at Portsmouth, one of the cutters tried was fitted with compound machinery of the ordinary type, and another with high-pressure machinery, and the coal consumption was measured for a period of four hours, every precaution being taken to ensure an accurate record; the boats were run together, and the steam-jet was not used at all with the compound machinery, the speed at which the trial was made rendering it unnecessary. As shown in the tables, Nos. 15 and 17, the consumptions per I.H.P. were 4·04 and 7·25 lbs. per hour respectively; that is, the high-pressure engine burnt 80 per cent. more coal per I.H.P. than the compound. Further comment upon this is unnecessary.

The result obtained in this case, with the compound machinery, emphasises the difficulty that exists in very small engines, especially with the boiler attached, of obtaining a high rate of economy; a result which has since been further confirmed by the trials of several small engines.

Several modifications in detail have since been introduced with the object of obtaining an improved performance, and a case has been illustrated in the tables, No. 16 giving the dimensions and particulars of a recent instance of compound natural-draught machinery of the size that would be fitted in a 25 ft. cutter, and the general arrangement is shown on Diagram F.

The engines are vertical compound, with two cylinders supported on steel standards, the pistons being of cast steel, with metal spring rings; a pass-valve is fitted to admit steam direct to the low-pressure valve-chest, in the event of any difficulty in starting; and the rods and shafting are of steel. The surface condenser is of the external type, and consists of a taper copper pipe on either side of the keel, secured at the ends by suitable gun-metal castings; the air pump is of gun-metal, and driven off the shaft by an eccentric; and there are also two gun-metal feed-pumps, each capable of supplying the boiler with water at full power.

The boiler is of the ordinary pinnace type, but the tubes are shorter and of smaller diameter, the tube surface remaining practically the same as with the high-pressure boiler of corresponding size, but the grate area is relatively larger.

Arrangements are made to exhaust directly into the funnel, in case of accident to the condenser, and a small auxiliary steam pump is provided for feeding the boiler, pumping out the bilge, &c., this pump being also arranged to work by hand. Tanks containing about 30 gallons of fresh water are carried on the side of the boat, for making up loss to the boiler.

In comparing the weights of the compound with that of the high-pressure machinery as fitted in similar boats, it should be stated that the amount of spare gear supplied has lately been increased, and if allowance be made for this, the weights of the two are practically identical; but the I.H.P. developed is greater with the compound engine, the weights per I.H.P. being respectively 1·35 and 1·66 cwts.

In the steam cutter the closed stokehold has not yet been adopted, and this plan is for some reasons inconvenient in these very small boats; in view, however, of the compartively low rate of combustion at present obtained, and the necessity of using a steam jet for full power, some further development in this class of machinery may, I think, be looked forward to, and this question is now receiving considerable attention.

There have been several other descriptions of machinery tried in these small vessels. Amongst others may be mentioned the Mallory system and the Hydraulic Turbine, which latter made an appearance some little time ago in a second-class torpedo boat; and a very recent development is a tubular boiler, the invention of Mr. Thornycroft, which has been successfully tried in a similar boat.

It is, however, not possible within the limits of this paper to deal with exceptional cases, the object here being merely to indicate the course through which the machinery generally of these boats has been and is still progressing, calling attention here and there to the leading features of interest and importance. I have also, on account of space, excluded the machinery of the torpedo boat, and dealt here only with machinery fitted in boats built until now of wood. Neither has any special reference been made to the propellers fitted in these boats, since, though anachronisms of performance due to this cause have by no means been absent, yet the questions to be considered in the analysis of the results are of a similar nature, whether occurring on a large or on a small scale, and are better met by a distinct investigation, which would enable them to be independently discussed.

In conclusion, I venture to hope that the progress indicated here in the design and construction of the machinery for these small boats may prove to be of interest, as showing that the advances made of recent times in naval marine engineering have been by no means confined to machinery on a large scale, but have simultaneously embraced even the smallest sizes.

ROLLED ZINC IN BOILERS.

We have recently had brought under our notice, by an esteemed correspondent, some interesting particulars regarding the use of rolled zinc in marine boilers.

The information supplied to us partakes of the nature of a paper on the subject, and we will now endeavour to give a brief *resumé* of this most interesting document, and which, we may mention, the position held by our correspondent prevents his publicly reading.

The author states at the outset that, as he was the first to apply rolled zinc to steam boilers, with a view to preventing corrosion therein, he naturally considers that he was the inventor of the system, and he then goes on to detail how this first application came about, of which more anon.

He then calls attention to the well-known fact that only a very few years ago the life of a boiler was but of very short duration indeed, and goes on to show how, by the careful distribution of zinc in a boiler, its life is now brought up to almost equal the life of the ship itself, or say to twenty years.

The author recalls to mind the trouble caused, when he was but a youth, by the corrosion of the iron on the bottoms of some boats built by the late Sir William Fairbairn. To remedy this, he reminds us, Sir Humphry Davy put a sheet of zinc between the brass sheathing, but in this case, to use our correspondent's own words, "the cure was nearly as bad as the disease." The reader is then asked to carry his mind back for upwards of half-a-century to the period when the late Mr. Hall, of Basford, brought out the surface condenser. With this then innovation several of Her Majesty's ships were experimentally fitted, but the destruction of the boilers was found to be very great. This led to the idea being abandoned, and for many years no attempt was made to again start the surface condenser. Both the late Mr. John Elder and Mr. Edward Humphrey tried it, but with no better results, as the boilers were soon found to be in a very corroded condition. To remedy the "pitting" the boilers were well brushed out with an iron wire brush and

washed with caustic soda and water, the "pits" being then filled up with Portland cement; this, however, soon proved itself an unsatisfactory solution of the difficulty and the boilers, internally, rapidly resumed their small-pox marked appearance, the pits quickly eating through the plates. This state of things continued for many years, spite of the numerous efforts made to overcome it. One plan consisted in putting zinc slabs in the feed boxes (*i.e.*, passing the feed water through a box with zinc slabs in it), so as to make them into what was thought to be electric batteries. This, however, soon proved itself a useless process, and no good was ever known to result from it. From 1860 to 1868 the author had charge of the machinery of a powerful ship fitted with surface condensers. Here the trouble of pitting soon began to show itself. This soon necessitated working the whole of one Sunday retubing a boiler. The pits had gone right through, and had it been the top row only that had failed it might have been attributed to the nails in the men's boots so cleanly were the holes cut out. After the completion of this work the author was led to think that undoubtedly something could be done to stop this pitting, and after much thought he determined to take his stand upon the teaching of Sir Humphry Davy's lectures Selecting one of the worst pits that he could find our friend tied a piece of zinc, on a stay close to it, with a piece of spun yarn. When the boiler was opened, after four weeks of steaming, the pit was examined and it was then found that it had coated itself with zinc. This result was considered very satisfactory, and a supply of zinc was accordingly indented for. From this slabs were cut to suit the amount of destruction to the plates. The next test consisted in dropping a sheet of ordinary zinc into one of the boilers so as to come between two of the furnaces, and after 45 days' steaming this was taken out and found to be "as green as grass," thus clearly showing the affinity of the zinc for the particles of brass that pass into the boilers.

The author still went on perfecting the application until the ship he was then in was fitted with high and low pressure engines. It was while so engaged that a very amusing incident occurred. Two out of the eight boilers with which the ship was provided were ordered to be fitted with a man's patent for preventing corrosion. This was nothing more or less than the author's own invention, but the unfortunate patentee had evidently not had much experience in the matter covered by his patent, for he caused too *much* zinc to be put into the boilers, that the deposits of zinc on the heating surfaces soon became so great as to render the cure worse than the disease. Of the eight boilers, two were at the patentee's risk, one at the resident engineer's, and five at the author's, and it was conclusively proved that the five latter were beating the others at about a third of the expense of zinc. The ship, unfortunately, was lost at this most interesting period of the trial, or more would undoubtedly have been known about the preservation of ocean-going boilers ere this.

After a trial extending over 17 years it was found that 11·4, or say roughly 11½ lbs. of zinc per ton of water in the boiler gave a very safe result, and this quantity should carry a ship from 25,000 to 30,000 miles.

All the ideas about metallic continuity with balls and wires are treated as "bosh," and finally the author tells us that an equal distribution of zinc hung in wires, and put in boxes below the water line in the boiler will be found to adjust itself.

THE DOWNIE BOILER SCALE PREVENTIVE AND REMOVER.

We have recently had brought under our notice a compound for preventing and removing the scale from boilers, and judging from the large number of original testimonials that were tendered for our inspection, we should say that it does thoroughly and well all that its proprietors, the Downie Boiler Incrustation Preventive Company, of San Francisco, claim for it.

The composition is prepared from the leaves of the Eucalyptus tree, which are boiled in a series of boilers or retorts under a pressure of 40 lbs. per square inch, the result being a thick, almost semi-fluid liquid.

From an official report made after trial of the compound in the boilers of the United States s.s. *Ranger*, and dated from the Navy Yard, Mare Island, Cal., we make the following extracts:—"The effects of the Eucalyptus have been as follows: Scale has been prevented from adhering to the heating surfaces of the boilers with any degree of tenacity: that is, in most cases the products have been easily removed by means of a steam hose, and in others have readily flaked off in large pieces when struck with a hammer. Scale already formed and adhering with great tenacity has also been detached from the heating surfaces, and thereby rendered easy of removal. The Eucalyptus preparation has been proven to protect the iron of the boilers from corrosion, comparison having been made between boilers in which the compound had and had not been used." Further on it is stated "it seems probable that the Eucalyptus, to some extent, protects the iron from waste by galvanic action and other causes." This remarkable testimony as to the efficacy of the Eucalyptus preparation is fully corroborated by one of the chiefs of the White Star Line who ends his letter by saying, "I hope never to be without it."

It does not injuriously affect the steam when condensed for drinking purposes, and the general manager of the Beaver Line states that, "it does not affect the water for cooking purposes or use by cattle. We are so satisfied with the value of your compound that we are now using it on all our steamers." Its cleansing effect on the condenser tubes, when injected through the condenser, is very marked, and the average consumption of fuel is invariably less when using the composition.

The Downie Company are exhibiting at the American Exhibition, Earl's Court, London, through their English agents, Messrs. Boult Brothers & Co., of 62, Dale Street, Liverpool, and elsewhere, and we have no doubt will meet with the success which so remarkable and valuable a preparation well deserves.

Collision Pad and Shield.—Messrs. Richardson and Co., divers and contractors, of North Shields, have patented an invention to prevent ships sinking after collision. It is said to be easily handled, and can be applied in a few seconds. The apparatus is made of canvas and steel, and is rolled up in a shape similar to a large roller window blind. When required for use the roll is hung over the ship's side, and unrolls itself over the fracture, which stops the inrush of water, the water rushing into the vessel being the chief means of unrolling the pad. It is then secured by a shield, and the ship can then proceed. These pads and shields are supplied in handy and compact water-tight cases, to be kept on deck or on the bridge of steamers, where they are always ready for immediate use.

LIGHT TORPEDO CRUISERS.

We have much pleasure in drawing the attention of our readers to a novel form of light torpedo cruiser constructed by Herr Schichau, of Elbing, for the German Admiralty.

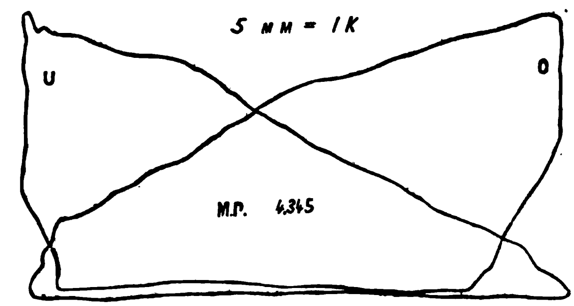
The external view given herewith sufficiently indicates the general arrangement of these vessels as seen from the outside, while the accompanying diagrams speak for themselves as regards distribution of steam in the cylinders.

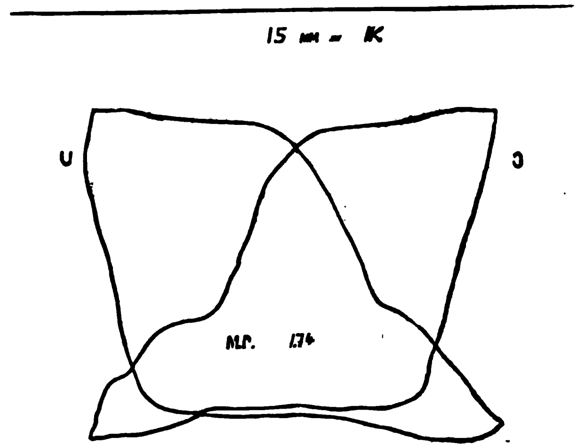
Officially the vessels are known as torpedo division boats. They are intended to serve the purpose of guiding a fleet or division of sea-going torpedo boats, and as the conditions laid down to be fulfilled by these vessels are very stringent in their nature, it may not be considered out of place if we here briefly recapitulated the leading requirements of the German Admiralty when placing the contract for the two vessels with Herr Schichau. The vessels were to have the same or even greater speed than the ordinary torpedo boats; they were to be capable of safely riding out any gale; they were to be able to take on board a full inventory of stores and spare gear for the whole division; they were to be fitted with complete workshop arrangements, smiths' fires, &c., to make any necessary repairs at sea; and they were also to be provided with hospital accommodation for sick and wounded. In addition, they were to be armed with torpedoes and quick-firing guns to enable them to take an active part in an engagement; to be strongly enough built to ram down a hostile torpedo boat; have as little draught as possible; show little surface above water, so making them all but invisible and giving little target for hostile projectiles. A large coal-carrying capacity was to be provided, and the vessels were to be fitted with economical engines to enable them to make long and fast voyages. In a word, it was required that a vessel which should be cheap in first cost, as well as in maintenance, should be capable of accomplishing the same, and even rather more services than formerly was required from large and costly vessels of the corvette type.

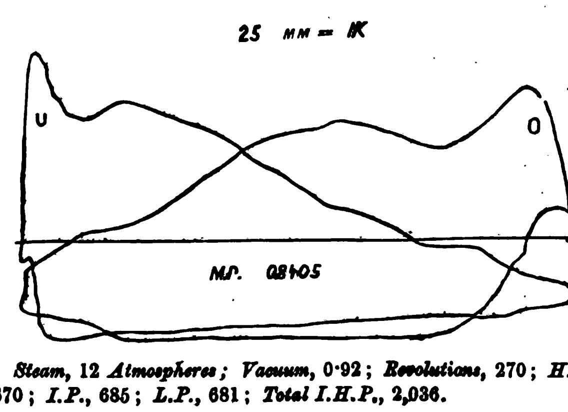
To fulfil all these conditions seemed, indeed, a difficult task, but the German Admiralty placed full confidence in the well-proved abilities of Herr Schichau, who has supplied a large number of sea-going torpedo boats to the German and other Governments, and last year placed the order for two such vessels with him, the long trials of which have just been brought to a most satisfactory conclusion, all expectations having been fully borne out.

The vessels are 55 metres long, by 6·8 metres beam, and have a displacement of 250 tons. Each vessel is divided into 12 water-tight compartments, each of which was tested separately during the trials to prove the stability of the vessel. Right forward are placed the torpedo tubes, apparatus for launching the torpedoes, and crew space. Aft of this is the workshop, fitted with all necessary tools and appliances; then follows boiler and engine room. Aft are spacious and handsomely-fitted cabins for commander and officers, and a large and elegant saloon buffet, and dressing room. The next compartment is taken up by the hospital; then follow cabins for mates and deck officers.

Steam and hand-steering gear is provided, and is so fitted as to allow of its being worked from both towers and from the commanding bridge forward of the funnel. Hotchkiss rapid firing guns are placed on the top of each tower and also on the broadsides. The three light masts serve for sailing. The ship is built throughout of the best steel.







Steam, 12 *Atmospheres*; *Vacuum*, 0·92; *Revolutions*, 270; *H.P.*, 670; *I.P.*, 685; *L.P.*, 681; *Total I.H.P.*, 2,036.

The engines are of the Schichau triple-expansion type, working at 270 revolutions per minute, and indicating about 2,000 H.P., as shown by diagrams. There are two locomotive boilers fitted with Herr Schichau's patent firing and ventilating arrangements. These supply all

the steam that is necessary for the main and auxiliary engines at a pressure of 112 atmospheres, or, say, 180 lbs. per square inch.

The boilers and engines are completely surrounded by coal bunkers.

On their trial the vessels made a mean speed of 21 knots per hour with full equipment and coal for 2,500 knots on a 10 knots speed on board. On the special storm trials, as prescribed in the contract, the vessels steamed under full power for eight hours straight against a very high sea and a gale of wind having a force of eight. The vessels were covered from stem to stern with splashes and foam, but the movements were not at all excessive, and in spite of these trying and adverse conditions a speed of 18 knots per hour was maintained throughout. This was a novel feature in the trials, and we cannot call to mind a trial of this kind ever having been stipulated for before, nor its accomplishment by a new ship.

The engines worked admirably from first to last, and great credit is due to the maker for the high state of perfection to which he has brought this class of quick running machinery.

So satisfied were the German Admiralty with the results of these trials that they have ordered two more of these light torpedo cruisers of Herr Schichau. The Austrian Government have also ordered from the same builder a similar but rather larger vessel for their navy. This vessel is to have a displacement of 300 tons, and with her engines, which are to indicate 3,000 H.P., it is estimated she will attain a mean speed of 21 knots per hour.

We would commend this new and very successful type of vessel to the notice of our own authorities, and we have no doubt but what it will soon come into more general use, as it well merits.

ON TRIPLE-EXPANSION MARINE ENGINES.*

ADJOURNED DISCUSSION.

(*Continued from page* 61.)

Mr. Parker said that during this discussion it had occurred to him, both at Leeds and here, that there were two or three points which required clearing up. He had taken a great deal of trouble to get some information with regard to one particular point that was raised by some speakers at Leeds, and that was whether having such high pressure, whether 100, 110, or 120, to utilise in a high-pressure engine, whether you could get anything like the same result in other than a triple-expansion engine. The figures he had got were obtained from actual practice, and unlike Professor Ryan, he had had some experience in stokeholes and served an apprenticeship there and in the engine room, so that he knew something about it. Two steamers, both working at 110 lb. pressure, one vessel had an engine of 47 in. high-pressure cylinder, 86 in. low-pressure cylinder, 4 ft. 9 in. stroke; that engine exerted 2600- H. P. and consumed fifty-four tons per day, representing 1·94 lb. per indicated horse-power per hour. The next steamer was one fitted with triple expansion engines, three cylinders, one 34 in., one 45 in., and 70 in. with a 4 ft. 6 in. stroke, working at the same pressure, namely, 110lb.; that engine exerted an engine power throughout the voyage of 1900 H.P., and she gave a mean consumption of 36 tons per day, or equal a consumption of 1·6 compared with 1·94. He thought it right to lay that before the meeting, because there seemed to be a difference upon it. With regard to Mr. Morrison's question as to what had been done with regard to forced draught, he could say that a steamer had been running and was now running between America and this country, and this for two and a-half years. The boiler that was fitted in has just one-half the heating surface that the previous boiler fitted in her had. He could not give the exact number of feet but it had three furnaces, as compared with six furnaces of the previous boiler there. The consumption per square foot of grate in the present boiler was over 50 lb per square foot, and, after running nearly two-and-a-half years, this boiler had been carefully examined, both internally and externally, and had not been found to have deteriorated in any way whatever from the rapid rate of combustion which took place in it from the forced draught. He was very pleased to hear that the Council of this Institution had determined to inquire into the mechanical working of marine engines, and he was very pleased indeed to render them all the assistance in his power, but, at the same time, he would remark that to his mind it was rather a difficult task. To measure the efficiency of a marine engine at sea was a very different matter from measuring the efficiency of an engine in a mill or factory, or an engine in a laboratory, or a locomotive engine. He had been thinking as to the best means of obtaining the diameters of the feed inlet, and of the outlet, and that was easily enough done; the temperature was easily enough done, but the volume of feed-water, and the measuring of the volume of circulating water, was, to his mind, somewhat difficult in a large engine, and that required to be done over some days. In some steamers that trade to this part the different feed pumps were from the ordinary style of feed pumps. They were made very slow running for the purpose of excluding all air. He thought to-day if they could measure those pumps carefully, and satisfy themselves that they were actually full, he could measure the revolutions or the strokes that those pumps would make, so that they measured feed-water, and perhaps Professor Kennedy and others connected with this committee could advise some other means. He was sure that steamship owners in the port of London would be very pleased indeed to give to this Research Committee all the information they could, and render them facilities for going down Channel to help them as much as they could to get this matter placed on a satisfactory basis.

Mr. Parker, in answer to Mr. Paget, said the boilers were exactly alike, except in the case of the large engines. They were large, of course, but they were identical in design.

Mr. Davey said the author of the paper had given 160 ft. per second as a steam velocity, and he had been accustomed to a very general rule in the land practice that for 500 ft., which seemed to be about the piston speed of those engines with the steam ports, you might put one-fourteenth or one-fifteenth of the cylinder; if they took the figure given by the author of the paper, which came to one-nineteenth; and if they took the figure given in the letter which the secretary read it gave one-fifth. There must be a very great discrepancy which wanted putting right.

The President said it was now after ten o'clock, and they could not go on any longer, but that it would be better that the discussion should now be closed. The sooner they increased the number of their meetings the better; and the sooner they had a building of their own to meet in they would carry on their discussions more frequently. This was a very important subject which had been brought before them, and he thought they might leave it in the hands of the committee. When they reported he hoped that some gentleman would bring forward a report, with some other papers, so that the question might be discussed again. In the meantime, he felt sure that they, all of them, would pass a vote of thanks to Mr. Morrison, the successor to, and in this matter representing, the late Mr. Wyllie.

* *Paper read before the Institution of Mechanical Engineers.*

Large quantities of slag are now being exported to Germany for the sake of the phosphates contained therein.

Quick Passage.—The new Orient Line steamer *Ormuz* has just completed a rapid passage homewards from Australia; she left Adelaide at 10 p.m. on April 4th, and arrived at Plymouth on Saturday afternoon, May 7th. The length of passage, including all stoppages and transit of Suez Canal, and adding the time allowance for difference in longitude, was 33 days 2 hours 30 minutes, or 30 days 16 hours 48 minutes steaming time. The average speed on the voyage, deducting the transit of the Canal, was 14·77 knots, equal to nearly 17 miles an hour. The mails by this steamer were delivered in London within 27½ days of being put on board in Australia.

FEED PUMPS FOR MARINE BOILERS.

As far as can be gathered from the reports that have been made public concerning the recent sad and fatal boiler explosion on No. 47 Torpedo Boat, and of a similar accident, happily attended without any serious results, on No. 57 Torpedo Boat, there can be only one cause assigned which could have produced these disastrous results, viz., shortness of water in the boilers. It cannot be from faulty workmanship in the boilers, for they were built under the immediate eye of an experienced overseer; nor from structural weakness did the explosion occur, for the boilers are tested to twice their working pressure—that is to 260 lbs. per square inch —at least twice before steam is ever raised in them, and on each occasion in the presence of an experienced Admiralty official, who would have detected the least sign of weakness and condemned the boiler if such existed. Then, before being accepted from the makers, the boiler and engines of each torpedo boat are worked at their full power for at least two hours, after which a most rigid examination is made. This crucial test proves that, under the most trying conditions, the boilers were quite capable of doing the work required of them, without any injury or straining to themselves, provided a proper supply of water had been maintained in them. Seeing that between 50 and 60 of these torpedo-boats were received by the Admiralty last year from Messrs. Thornycroft, Yarrow, and White, and that the boilers of all of them passed satisfactorily through all the tests and trials required by the Admiralty, and also that several of these boats have had a great deal of service, while being used as instruction boats for the *Vernon* and steam reserves, the question arises why should two boilers give out under almost identical circumstances. It is well known that an excessive heat in the furnace will drive the water off the plate, if the plate be thick or covered with scale; but in these two boilers, which are of the locomotive type, the crowns of the fire boxes are not thick, and the facilities for using fresh water are so great, and the regulations restricting the introduction of sea water into these boilers so stringent, that it is only fair to assume that the heat was transmitted through the plate to the water as fast as it was received. With the high temperatures existing in furnaces worked under forced draught, any imperfections in the manufacture of the crown plate would become more developed; but this would chiefly happen when the boilers are first tried to their utmost. One or two cases did occur in which, after the full power trial, a blister was observed in these crown plates, which, on investigation, showed that the intense heat had found out a part of the plate not perfectly homogenous, but in which a lamination existed. In each of these cases new crowns were fitted to the fire boxes, and the whole series of tests and trials repeated. The only conclusion to be arrived at is that the water in the boilers got short, and that the feed arrangements failed to act sufficiently quick to prevent the crowns being left bare.

Seeing that the safety of the boiler depends on the efficiency and prompt action of the feed arrangements, it will be worth while to enquire into the present practice for supplying marine boilers with water. With the high pressures now used—150 lbs. being a common working load—and the intense heat developed in the furnaces and combustion chambers of boilers worked under forced draught, it becomes a most serious matter if the supply of feed water is checked even for a short time. With low pressures and natural draught combustion the fires could be easily drawn in the event of the water disappearing out of the glass, and all danger would be thus averted, as the furnaces would rapidly cool down; but when the boilers have been working under forced draught, the heat is so much more intense that it is far from being an easy matter to draw fires. The glare is so great that a man can scarcely see what he is about, and the radiant heat from the open furnace door makes it a burning question to take out fuel from off the bars. When the bars and furnace door are at the one height, the difficulty is certainly very great; but when, as in these locomotive boilers, the furnace door is placed at some height above the bars, the drawing of fires rapidly is an impossibility. Were it possible, however, to get all the live fuel off the bars, the bridges, bars, &c., have such a large quantity of heat stored up in them as to practically keep the water boiling long after the fire has been drawn. With forced draught the generation of steam is 50 per cent. faster than with natural combustion; so that should the feed be checked through any cause, the crowns of the furnaces or combustion chambers will become uncovered with water in only two-thirds of the time that it would take under the old system of combustion. Again, once the plates exposed to fire become uncovered with water, with the forced draught they rapidly become white hot, while, in former days, a bright red would have been their colour. The difference in strength between a red-hot and white-hot plate is something considerable; and although the latter is so much the weaker, yet in modern boilers short of water it has to stand a much higher pressure.

The adoption of forced draught has therefore greatly increased the anxiety and responsibility of the engineer, as he must be more certain of the efficiency of his feed arrangements, and be much more prompt and quick in his measures to guard against accidents arising through lowness of water in the boiler. This question is one that the engine-builders should bear in mind, so that the engineer may have an efficient, handy, and quick arrangement for supplying his boilers with water.

All marine boilers are fitted with at least two systems of feed, known as the *main* and *auxiliary or donkey* feed. These two systems should be entirely separate and independent, so that an accident to one could in nowise interfere with the other. In the Navy a third pump is fitted, which, however, delivers into the main feed pipes; this is the *hand pump*, which can be worked either by hand or from the end of the crank shaft.

Till within the last few years the main feed pumps were always worked from some part of the propelling engines, such as the piston rod cross-head, or the air pump cross-head in vertical engines, or by the cylinders themselves in oscillating engines. When thus worked, the feed pump was invariably a single-acting plunger pump; but the present Admiralty practice is to have the main feeds entirely independent of the main engines, and to be driven by small separate engines. When driven by the main engines the feed pumps could only be used when the ship was in motion; but in a modern man-of-war there are so many occasions on which steam is raised, and yet the propelling machinery may be stationary, that the main feeds would be practically useless. Thus, at target and torpedo practice, where a full head of steam must be kept, and yet the engines are only worked at intervals, the auxiliary feed had to be entirely depended upon under the old system. Again, if the main feed pump did not act satisfactorily when driven by the main engines, it could not be well examined or repaired without stopping. The main feeds were always in the engine-room, and often below the floor-plates, well out of sight. They were thus a long distance from their work, and not under the control and vigilance of the proper person, who was in charge of the boilers. Instead, therefore, of the feed to the boilers being regulated by the supply to the pump, it was generally done by the valves on the boilers, which were often, in consequence, shut without any reference being made to the engineer in the engine room; and from the relief valve of the pump generally being in the bilge and often set fast with rust and dirt, there was nothing left but for the pump to break down or the pipe to burst. In the latest ships of the Navy, all the feed pumps will be if possible in the boiler rooms close to their work, and under the immediate control of the person in charge of the boilers, who will thus be able to regulate his feed much better by the pump than by the valves of the boilers. Until recent times, the speeds of marine engines ranged from about 25 to 120 revolutions per minute, at which speeds pumps are generally very efficient, but in the case of torpedo-boats, and even vessels of a larger type, the speeds have increased up to from 350 to 400 revolutions per minute. With this increase of speed there has also been an increase in the pressure of the steam in the boiler; and therefore when driven direct by the main engines the feed pumps at these speeds are not nearly so efficient; but having to pump against great pressure, the chances of breaking down are greatly increased. Contrivances are sometimes fitted, such as the worm and wheel in the Thornycroft and Schichau torpedo-boats, for reducing the speed of the pump when driven by the main engines; but this arrangement is not so satisfactory as having a separate feed engine.

With naval ships the present tendency of marine engineering is to simplify the main engines as much as possible, by detaching all pumps and extraneous work from them other than that of directly propelling the vessel. This is to make engines handier for manœuvring with, and to lessen the chances of the ship being stopped through some accident to one of the small details of the machinery.

The auxiliary or donkey feed has always been a separate pump, driven by its own engine; and was formerly the only way of feeding the boilers when distilling, or when the main engines were not running. Injectors or inspirators are often fitted in lieu of donkey feed pumps; and as the whole of Yarrow's torpedo boats are fitted with Hancock's inspirators, while Thornycroft's boats have a Tangye special pump for auxiliary feed purposes, the present cruise of the fleet of torpedo boats should settle the

vexed question of which is the most efficient for the service. Engineers have hitherto looked with disfavour upon injectors, because the earlier types required a little humouring to get them to work, and they could not always be relied upon; and other objections are that injectors will not draw from any great depth or through any great resistances, and also that they will not work with water above 150 deg. Fahr. But prejudice is gradually dying out, for it is seen that on railway locomotive boilers they are chiefly used with great success, and there is no reason why they should not answer with marine boilers. They act very efficiently, and are economical, as all the heat in the steam used in them is returned into the boiler. They are much lighter and more compact than a donkey engine and pump, and require fewer pipe connections; they have practically no working parts to get out of order, and cost but little compared with pumps; and as they send the feed into the boiler at a temperature of from 150 to 170 deg. Fahr., their use must tend to preserve the boiler longer than when a donkey pump injects cold water into it.

In a man-of-war, which is always now driven by twin screws, each set of engines is made complete with its own set of main and auxiliary feeds, and all other pumps; so that in the event of the ship being partially disabled, by ramming or other cause, one set of engines could always be used. To simplify matters somewhat, the Admiralty have a pump of their own design, made in several sizes; and this pattern pump is always now fitted for the main feeds, auxiliary feeds, bilge pumps, fire engine pumps, drain pumps, &c. This is very desirable, as if all the pumps in an ironclad, and numbering perhaps between twenty and thirty, were of different designs and make, it would take a whole commission to get the men accustomed to them; whereas by having only one type of pump, the whole of the engineer's staff soon become acquainted with its action, and can then work any of the pumps in the ship.

In a large ship there would be for the main feed one Admiralty pump, No. 1 pattern, in each boiler room, to pump from the feed tanks, bottom of condensers, and the sea. Each pump is so fitted that it can pump into any of the boilers and from the feed tanks or condenser in either engine-room. For the auxiliary feed service there is also a No. 1 Admiralty pump in each boiler room pumping from the sea and feed tanks only. All the pipes and connections must be entirely separate from the main feed system; and each pump must be capable of pumping into any of the boilers from either feed tank.

LAUNCH OF THE COMPOSITE SLOOP "BUZZARD."

On May 10th there was launched from the building slip at Sheerness Dockyard the new composite sloop *Buzzard*. There was a large attendance of spectators, including Vice-Admiral the Prince of Leiningen, G.C.B., Commander-in-Chief at the Nore; Capt. Sir Robert H. More Molyneux, K.C.B., Superintendent of Sheerness Dockyard, and the principal officers of the port and garrison. The service appointed for such occasions was read by the Rev. S. S. Brown, chaplain of the dockyard, and the responses were said by the choir of the dockyard church. Lady Molyneux christened the vessel, and after the usual preparations severed the final cord, which launched the ship into the Medway. She glided down the ways in capital style. The *Buzzard* was at once secured by two Government steamers and towed to moorings off the dockyard. The *Buzzard* is the first of a new class of fast, heavily-armed composite sloops, designed for the Royal Navy by Mr. W. H. White, the present Director of Naval Construction. She is unarmoured, but her vital parts are protected by a steel deck extending the entire length of the ship. The principal dimensions are as follows:—Length between perpendiculars, 195 ft.; breadth, 30 ft.; mean load draught, 12 ft. 2 in.; displacement at load draught, 1,075 tons; weight of hull, 584 tons. The *Buzzard* is to be fitted with machinery of the new triple-expansion type, which will be supplied and fitted by the Barrow Shipbuilding Company, and is estimated to develop 2,000 H.P. The armament of the *Buzzard* will consist of eight 5-in. steel breech-loading guns, which will be mounted on Vavasseur fittings, four 1-in. Nordenfeldt machine guns, and four 45-in. Gardner machine guns. She is to be barque-rigged, and when ready for sea will be manned by a crew of 120 officers and men. The estimated cost of the *Buzzard* when armed and fully equipped is £68,219. The *Buzzard* is adapted for service as a despatch vessel or for independent cruising. The Admiralty propose to build two more ships of her class during the ensuing financial year.

THE SHIPPING TRADE.

The disappointed condition of shipping interests during late years is due to the enormous increase of steamers, so much more in excess of the then existing requirements, as it coincided with the beginning of the period of universal trade depression and a consequent slackness of the trans-oceanic commerce. The present restriction in the construction of new vessels, as well as the ordinary wear and tear and total losses incurred by the world's steamer fleet, have had the effect of diminishing the previous disproportion between demand for and supply of steamship accommodation, and a revival of trade is, under these conditions, sure to act at once favourably upon the shipping industry, which is now undoubtedly in a satisfactory and healthy position. It is not possible to state in detail the loss which capital engaged in shipping enterprise has really sustained during the grave crisis from which we are just emerging, but the trading results and quotations of some large companies indicate it to some extent. The surest guide in this respect is given by the great English companies which have the lead of the world's shipping. As the aggregate capital they employ is estimated at £14,000,000, it represents, however, only a fraction of the grand total of English money invested in shipping, which is variously stated to amount to £200,000,000 or £250,000,000. Yet the movements in the price of the following nine companies fairly illustrates the unfavourable circumstances under which shipping in general has been conducted since 1881.

LONDON QUOTATION.

Name of Company.	Dec. 1881.	Dec. 1882.	Dec. 1883.	Dec. 1884.	Dec. 1885.	Dec. 1886.
Transatlantic:						
Cunard .. .. £20 paid up	20½	16¾	13½	10½	9¾	10½
National.. .. £10 ,, ,,	8¾	7	5¾	2	1¾	2
South African:						
Castle Mail Packet £14 paid up	21½	18	13½	13	12½	9½
Union .. .. £20 ,, ,,	29	25	15	16	15½	15
Central and South American:						
Amazon .. .. £15 paid up	13½	13	12	8½	6½	7½
Royal Mail .. £60 ,, ,,	61½	58½	51	50	46	39
Australia, &c.:						
General .. .. £15 paid up	21	20	18½	14½	9½	7
Orient .. .. £8 ,, ,,	—	5½	5¼	5	6¼	6½
Peninsular and Oriental .. £50 ,, ,,	62	60	59	58	60	64

This table discloses a very intelligible picture. Only the last two companies have maintained, or rather improved, their former prices, but considering that both the "P. and O." and "Orient" are in receipt of Government subventions as mail steamers, they are to a great extent outside the general competition. The shares of the remaining seven companies have on the other hand suffered immensely, and are partly reduced to half, a third, and even a fourth part of their value in 1881. It will be noticed that the greatest fall took place between the years 1881 and 1885, whereas a stand was made in 1886, and in several instances even slight advances are established. The same observation refers to non-English steamship companies, from which we select some which are quoted at the Berlin Bourse.

BERLIN QUOTATION IN PERCENTAGE.

Name of Company.	Dec. 1881.	Dec. 1882.	Dec. 1883.	Dec. 1884.	Dec. 1885.	Dec. 1886.
North German Lloyd	175	146	133½	121½	109½	121¼
Hausa	—	95½	94	50	50½	56¼
Neptun	152	150	150	114	101	100
Union	150	140	110	102	99	95

The above examples show, like the former, that the violent fall was arrested last year, and that a considerable recovery has even taken place in two instances, though the fall since 1881 is in both cases still enormous. The improvement which has set in deserves, however, unqualified attention, more especially as all appearances point to the conclusion that the advance thus secured is not the result of a passing tendency but the first indication of a more promising future.

LAUNCH OF THE TORPEDO CRUISER "RACOON."

On May 6th the *Racoon*, one of the *Archer* class of torpedo cruisers of which several have already been built, was launched from Devonport Dockyard. Although the weather was very unfavourable, the launch was witnessed by 5,000 spectators, including Admiral Augustus Phillimore (Naval Commander-in-Chief), Rear-Admiral Grant (Admiral Superintendent of Devonport Dockyard), and a large number of other officers, both naval and military. The ceremony was successfully performed by Miss Annette Grant, daughter of the Admiral Superintendent. The *Racoon* is to be brought forward for commission with all despatch. The keel of the *Racoon* was laid down in February, 1886, so that she has been just 15 months building. She is 225 ft. long, and has a displacement of 1,600 tons. She is built entirely of steel, but is 1,000 H.P. in excess of either the *Archer*, *Brisk*, *Cossack*, *Mohawk*, *Tartar*, or *Porpoise*, all vessels of the same class. Her boilers are four in number and placed in the ship in pairs, each pair being in a separate water-tight compartment; so also is each set of engines, the object being to minimise the loss of propelling power in the event of either or any of the compartments becoming filled with water. The *Racoon* is expected to attain a high rate of speed, as, with the ordinary draught, it is believed she will develop at least 2,500 H.P., while with the forced draught, and the engines working about 150 revolutions per minute, the H.P. will probably be not less than 4,500. Her armament will be of a very formidable character, consisting of six 6-in. breechloading guns mounted on Vavasseur central pivot carriages, eight 3-pounder quick-firing guns, two Nordenfeldts, and one 7-pounder. There are also five torpedo tubes for firing 14-in. Whitehead torpedoes—one placed in the bow of the vessel, one on each side forward, and one on each side aft. These tubes are fitted to the vessel's side by ball and socket joints, an arrangement which enables the torpedoes to be fired in a direct line with the keel. The vessels of this class will, when ready for sea, be amongst the most formidable in the navy, and it is anticipated that they will accomplish a speed of 20 knots an hour. The total cost of the *Racoon*, when fitted and armed and ready for sea, is estimated at £100,000.

LAUNCH OF H.M.S. "SANS PAREIL."

On May 9th H.M. twin-screw armour-plated battle-ship *Sans Pareil* was launched from the dockyard of the Thames Iron Works and Shipbuilding Company at Blackwall. The interest manifested in the event was very great, and thousands of spectators gathered in the dockyard and its neighbourhood. Bright flags and streamers decked the *Sans Pareil* and fluttered from the masts of the surrounding craft. The launch of the vessel took place at 2 o'clock, after a short religious ceremony, which was conducted by the Rev. Canon Scott. Among those present were Lord and Lady George Hamilton, Lord Elphinstone, Mr. Ashmead-Bartlett, M.P., Mr. A. B. Forwood, M.P., Lord and Lady Walter Kerr, Mr. W. H. White, Director of Naval Construction, Sir Gerald Fitzgerald, Mr. F. C. Hills (chairman of the Thames Iron Works and Shipbuilding Company), Mr. Arnold Hills (managing director of the company), Rustem Pasha, M. J. Gennadius, Mr. C. T. Ritchie, M.P., Mr. W. L. Jackson, M.P., Mr. A. Lafone, M.P., Mr. W. S. Caine, M.P., Mr. Sydney Buxton, M.P., Major Banes, M.P., Mr. E. S. Woods (President of the Institute of Civil Engineers), Sir James Douglass, the Bishop of Sydney, Sir James Garrick, Sir P. Jennings, Sir Nathaniel Barnaby, and Mr. Beeton. The ceremony of launching the vessel was performed by Lady George Hamilton punctually at 2 o'clock by severing a silken cord with a silver axe; and just as the enormous ironclad moved away her ladyship, breaking a decanter of wine against its side, christened it the *Sans Pareil*. As the vessel glided smoothly down the ways into the water the band struck up "Rule Britannia," and the spectators, waving hats and handkerchiefs, cheered again and again with the heartiest enthusiasm. Nothing could have exceeded the smoothness and ease with which the *Sans Pareil* took the water, and the whole of the proceedings passed off in a most satisfactory manner. The following are the principal dimensions of the *Sans Pareil*:—Length, 340 ft.; breadth, 70 ft.; depth, 37 ft. 6 in.; displacement in tons, 10,470; engines, 7,500 I.H.P. natural draught, and 12,000 I.H.P. forced draught, by Messrs. Humphrys, Tennant & Co. Armament:—Two 16-in. 111-ton guns, 12 6-in. 5-ton guns, nine 3-pounder quick-firing guns, one 10-in. 29-ton gun, 12 6-pounder quick-firing guns, two 1-in. Nordenfeldt guns, eight 14-in. Whitehead torpedo tubes, and four 0·45-in. Nordenfeldt guns. The *Sans Pareil* has 170 watertight compartments, necessitating the introduction of 909 watertight doors, scuttles, and valves, and the steam engines, main and auxiliary, amount to 55 in number. The stern frame, rudder, ram, and propeller brackets were supplied in cast steel by Wm. Jessop and Sons, Limited, Sheffield. The contract for this vessel was taken on April 21, 1885, and the first keel plate was laid on June 26. The deadweight of the *Sans Pareil* is stated to be 6,000 tons, a greater weight than any launched in this country since the launch of the *Great Eastern*.

A luncheon was held in one of the company's workshops after the launching of the vessel. The shop was tastefully decorated with flags and bunting, and there were many ladies and gentlemen present. Mr. F. C. Hills presided, and in proposing the toast of "The Queen" referred to Her Majesty's long reign as one which might appropriately be described as *sans pareil*.

The Chairman next proposed "Success to the vessel *Sans Pareil*." After dwelling on the character of the vessel and her capabilities, the chairman said that he thought she would prove herself worthy of the name which had been given her that day by Lady George Hamilton.

Mr. Arnold Hills, in proposing the health of Lady George Hamilton, said that he regarded that day's launch as one of the greatest marvels of applied science, inasmuch as 6,000 tons which had been lying there for months and years motionless had been at last released and set into motion by the touch of a lady's hand. They had seen that day the latest daughter of their hopes, the *Sans Pareil*, gliding down the ways to meet her lord, the ocean. That vessel's eldest sister, the *Warrior*, was a ship of some 8,090 tons full-rigged and sails. The *Sans Pareil* had no sails, and was of 10,000 tons displacement. The *Sans Pareil* had 18 in. of steel-faced armour; the *Warrior* had only 4 in. of iron armour. This showed the enormous difference in the fighting powers of the two ships and the progress that had been going on during the last twenty-eight years. Her Majesty's Navy to-day was stronger than it had ever been before. Mr. Arnold Hills concluded by proposing "The health of Lady George Hamilton," which was drunk amid loud cheers.

Lord George Hamilton, on rising to respond, said that he desired, on behalf of Lady George Hamilton, to express her thanks for the cordial manner in which the toast had been received. Satisfactory and impressive as the launch had been, it must not be forgotten that it was the outcome of months of anxious thought and careful calculation, and he did not believe there was any yard in this world, however ably administered, the managers of which, though they might have absolute confidence in their calculations and their men, did not breathe more freely when they saw a successful launch like that which had taken place that day. The *Sans Pareil* was originally a French ship, and was taken by the English in 1794. Like many other French ships, it became one of the most effective in the Navy. In 1851 another vessel took its place and name, but although so long a time had elapsed between the building of those two vessels, shipbuilding had made very little progress, and that launched in 1851 was built very much on the lines of the earlier one. The present vessel showed a great contrast. In the vessel taken from the French the length was 193 ft., breadth 51 ft. 6 in., displacement 3,500 tons, complement 814, weight of metal from broadside 960 lbs., weight of powder from broadside 200 lbs. In the second *Sans Pareil* the length was 200 ft., breadth 52 ft., displacement 3,700 tons, complement 700, weight of metal from broadside 1,640 lbs., weight of powder from broadside 320 lbs., speed nine knots. In the present vessel the length was 340 ft., breadth 70 ft., displacement 10,470 tons, complement 550, weight of metal from broadside 4,750 lbs., weight of powder from broadside 2,320 lbs., speed about 17 knots. The complement in this vessel was made up of 37 officers and 513 men and boys; about one-fourth of the officers (including engineers, paymasters, &c.) and rather more than one-fifth of the men might be regarded as non-combatant, about 110 men being employed on the engine-room staff. This proved that during the past thirty years we had made greater progress in shipbuilding than had been made in the 500 years preceding. If we were to maintain our supremacy on the sea, our armour-clad fleet must be stronger than any other armour-clad fleet. Whether we built more armour-clads in future depended on what foreign nations did. If it were necessary to do so it was satisfactory to know that there were private firms in this country who were capable of executing their contracts with rapidity and

ability. He hoped that whoever in future might be at the head of the Admiralty Department might find firms ready to carry out the work intrusted to them with the same rapidity and the same reliability as that which had always characterized the work of the Thames Iron Works and Shipbuilding Company. His lordship concluded by proposing the health of the chairman, which was heartily received.

TRIAL OF A NEW STEEL SCREW TUG FOR RIVER AND CHANNEL SERVICE.

THE very successful trial of a steel tug built by Messrs. Steward & Latham, shipbuilders and engineers, South Dock Iron Works, Blackwall, was made on May 21st. The trial was an official one, and was made previous to handing over the vessel to her owner, Capt. John Spicer, who is to be congratulated on the possession of a craft which proved herself, both as regards machinery and hull, one eminently fitted for the successful and economical discharge of her duties. Briefly, the vessel, which is strongly constructed throughout of Siemens-Martin mild steel, has a length of 71 ft., a beam of 14 ft. 6 in., and a depth of 8 ft. 6 in., and is not inappropriately named the *Jubilee*.

The *Jubilee* is fitted with inverted direct-acting compound surface-condensing engines, the cylinders being 14½ in. and 28 in., with a stroke of 22 in. The boiler is also built of steel, and is 9 ft. 3 in. diameter by 8 ft. 9 in. long, with a heating surface of 725 square feet, and is altogether a fine boiler and especially suited for the hard work, which lays before it. It is weighted to a working pressure of 80 lbs. on the square inch, and was pressed by Lloyd's surveyor to 160 lbs. cold water. Upon a mean draught of 7 ft. she displaced 47·40 tons gross, and 5·99 tons registered. The mean of four runs on the measured mile showed her speed to be 10·52 miles, steam pressure, 78, vacuum, 27, revolutions, 120, and indicating 190 H.P. Speed, we may, however, say was not the main object of the builders, but to prove her capabilities as a tug, for which purpose she is fitted with a patent propeller, the good qualities of which were manifested throughout the trial. Both on the measured mile and in putting her about she behaved in a manner both satisfactory to the builders and pleasing to the owner, everything working in a perfectly cool state from first to last of the trial. An Emerson, Walker & Thompson Bros., Limited, patent steam windlass is also fitted.

More than usual interest was taken in her trial, as special efforts have been made to make the *Jubilee* the most economical and useful tug on the Thames, her consumption per I.H.P. per hour being 2·18 lbs. (under pressure). This under ordinary going would be reduced to less than 2 lbs. per hour.

We must congratulate the builders upon their success, and there is no doubt that owners of tugs must study the one important fact that the success of a tug is mainly due to her consumption of fuel, and from an economical point of view it should be pointed out that the patent propeller, while giving a high rate of speed, does not appear to have increased the coal consumption of this handy and successful vessel. Such a vessel will, we feel sure, commend herself to all tug owners, and we are convinced that she marks a new era in this class.

A SWIFT TORPEDO BOAT.—Messrs. Thornycroft, the torpedo-boat builders, of Chiswick, have just completed a new torpedo-boat for the Spanish Government, which for speed, it is stated, has beaten anything that has yet been built. The new boat is 147 ft. 6 in. in length, has a beam of 14 ft. 6 in., and draws 4 ft. 8 in. of water. She has two patent tubular boilers and twin-screw compound engines, which act independently of each other, while the steering gear consists of two curved rudders, which make her extremely handy, as she is able to turn about in three times her own length going at ordinary speed, which on trial was 15·84 knots with the natural draught. On a recent trip, with the tide in her favour and forced draught, she attained the extraordinary speed of 29·01 knots, or a rate of nearly 33½ miles an hour. Her times on the measured knot were, for two runs of a knot each, with the tide, 2m 10s and 2m 11½s, while against the tide, for three runs, the record was 2·25, 2·25, and 2·25½, giving a mean speed of 26·18 knots, or over 30 miles an hour. She is divided into a number of watertight compartments, and in case of being hulled by shot is fitted with ejectors capable of discharging 480 tons of water per hour. She has two torpedo tubes in the bows, and has space to carry four Schwartzkopf torpedoes, and will mount four Nordenfeldt machine guns.

INDUSTRIAL NOTES.

THE CLYDE AND EAST AND WEST OF SCOTLAND.

THE booking of orders in the Clyde shipbuilding industry during the past week or so has not proceeded at anything like the pace with which work on hand has been completed, and measured thus the industry is seen to lie under the same cloud of depression which has long existed. The misery and suffering which this long-continued state of matters has entailed upon thousands of artizans, provident as well as thriftless, who have been denied employment, are as great as ever, but, thanks to the generous summer now entered upon, these evils will be less acutely felt than during the cold and dismal winter months. The past few weeks have not been entirely devoid of events connected with new work. Some of these are merely promissory, while others take definite shape as actual orders. The most notable of these events, of course, is the important commission with which Messrs. J. & G. Thomson have been entrusted by the Inman and International Steamship Co., for the building of two steamships of the largest class, presently employed in the transatlantic mail and passenger service. In point of size alone these new vessels are noteworthy, being about 8,500 gross tons each, but in respect of other features, such as proportions, speed, means of propulsion, and structural character, they will be the most remarkable productions in marine architecture since the *Great Eastern*. Particulars of their design are of course not yet obtainable—indeed, in many essential points their design is not yet definably fixed, but it is understood that they will have several outstanding characteristics which will distinguish them from all previous vessels employed in the same important service. These are propulsion by two screws actuated by two separate and self-contained sets of engines and boilers of the most modern type, as regards high pressure and increased expansion of steam, and the minute sub-division of the hull by longitudinal and transverse watertight bulkheads, rendering the ship unsinkable through collision with another vessel, and almost absolutely unsinkable from any cause whatever. It is expected that these vessels will attain a speed of nineteen knots per hour on trial. These two vessels make the fourth and fifth transatlantic steamships now under construction. The Fairfield Shipbuilding and Engineering Co., of Govan, have well advanced a large screw steamer for the North German Lloyd's New York and Southampton service, and Messrs. Harland and Wolff, of Belfast, are building a couple of large steamships for the White Star Line. When these several vessels commence their sailings the greatest interest will doubtless be manifested in their performances as regards speed, since all are expected to give the present greyhounds a hard tussle for supremacy.

Messrs. Russell & Co., from whose yards at Greenock and Port Glasgow a constant stream of sailing ships have issued for several years, have lately undertaken the production of steamships, the engines for which are being supplied by Greenock engineers. They have at present four steamers in hand, besides a number of sailing ships. Their last order, received about the beginning of the month, is for a large steel screw steamer, intended, it is believed, for the American petroleum carrying trade. The vessel is to be about 3,500 tons net register, and is to the order of a Liverpool firm.

It is announced that one of the London cable companies have decided to get two new screw steamers specially built for cable laying and repairing, and that the order has come to the Clyde. The vessels are each about 1,800 tons, and are to be built of steel. Messrs. David J. Dunlop & Co., Inch works, Port Glasgow, have secured a contract to build a steel screw steamer for the London and Tilbury Lighterage Company (Limited), London, for towing purposes on the Thames. The Messrs. Dunlop have already built a number of vessels for this company, and the one they have now contracted for will be a duplicate of the one last built for the same owners. Messrs. Matthew Paul & Co., Dumbarton, have fixed with the African Lake's Company, Glasgow, for the building of a steel screw steamer, 80 ft. in length. Messrs. Paul & Co. will supply the machinery, and will probably arrange with a local builder for the construction of the hull of the vessel.

The s.s. *Balmoral Castle*, which, as stated in last month's notes, was sold by Messrs. McMillan & Sons, of Dumbarton, is being brought back to Dumbarton for alterations necessary to fit her for the frozen meat trade.

The Clyde-built ship *Ocean King*, owned by Messrs. William Ross & Co., London, which recently had her engines altered from the compound into the triple-expansion system, underwent a trial of same while *en route* from Swansea to London, and the satis-

factory speed of 13 knots on a small consumption of fuel resulted. The cylinders are 26 in., 43 in., and 68 in. in diameter, with a 48 in. stroke, and the engines are capable of developing 2,200 effective H.P. There are two double-ended circular steel boilers, 12 ft. 9 in. mean diameter and 16 ft. 6 in. long, having eight Fox's corrugated furnaces of large external diameter. The working pressure is 150 lbs.

Shipbuilders and shipowners have often cause to feel aggrieved at the hasty and premature—sometimes groundless—statements of orders booked, made by the daily press. It is scarcely necessary to say that publicity in cases where arrangements are undergoing consideration, though not by any means completed, is calculated to do the shipbuilders an amount of harm with their clients. Through the mistaken zeal in furnishing "the latest," Glasgow newspapers have more than once been compelled to publish flat contradictions to statements made in their previous issues. One such case happened during the month. A paragraph to the effect "that Messrs. Wm. Denny & Bros., Dumbarton, had received orders to build two very large vessels for a Spanish firm," having to be contradicted as being devoid of truth. It is pretty generally known that a Spanish company, for which Messrs. Denny has largely built, contemplate adding to their fleet several vessels of the most modern mail and passenger type, and only await the passing of a Government bill, from which a substantial subsidy will result, before proceeding with the new vessels. Whether Messrs. Denny or any other Clyde firm will receive the order is, of course, a matter of mere conjecture. It is even possible that the company's advisers may recommend the purchase of some mail and passenger steamers already built, and at present not very profitably, if at all employed. A cheering bit of intelligence for Clyde builders and artizans comes in a telegram from Brussels, which states that, owing to the great dissatisfaction with the way in which the mail service between Dover and Ostend has been lately conducted by two steamers built in Belgium, the Government of that country has determined that the two vessels at present doing the service will either be withdrawn or their engines will be replaced by new and more powerful ones, while two new boats will be built in Great Britain, probably on the Clyde.

The Belgian Government has provisionally chartered at Liverpool a swift steamer for use while the two new packets are being built.

A noteworthy departure in the nanner of constructing steamship hulls has been made lately on the Clyde in the shape of the application of a new electro-magnetic drill, invented and introduced by Mr. F. J. Rowan, C.E., Glasgow, for the purpose of boring instead of punching the rivet holes in hulls of vessels, boilers, &c. The drilling machine, which has been at work on the shell of the *Albania*, just launched from the yard of McMillan and Sons, Dumbarton, is of a light weight, and attaches itself to the plating by electro-magnets, and the drill is driven by electrical energy applied to a motor of suitable construction. By the adoption of these machines it is rendered practical to bore the whole of the shell of the vessel, producing work superior to anything hitherto accomplished in shipbuilding, the extra cost of which must be more than compensated by the possibility of reducing the weights in the construction of the vessels, and the greater safety arising from the perfection of the work. A riveting machine, the invention of Mr. Rowan and of Mr. John McMillan, of the above named firm, is also being tried in the riveting of shell plating. In this machine the hammers are withdrawn by the motor against the action of powerful springs, and on reaching a certain point are released, so that the springs deliver the blow previous to the hammers being again withdrawn. About 150 blows per minute are thus delivered on the rivet head. Both these novel machines will be exhibited shortly at the Newcastle Exhibition.

The suggestion made some time ago by Mr. D. Pollock, consulting naval architect, of 128, Hope Street, Glasgow, and warmly seconded by Mr. W. J. Millar, secretary to the Institution of Engineers and Shipbuilders, that efforts should be made to remove the remains of the old *Industry*, presently rolling away in its harbour of Bowling, to the site of the forthcoming exhibition, has again been made by several correspondents in the Glasgow Press. This vessel, or what remains of her, is without doubt the oldest steamship extant, and it seems a great pity that she cannot be rescued from the fate which is gradually overtaking her, as she lies exposed to the wash of the tides at Bowling. She was built in 1814 at Fairlie—now so noted for craft of a lighter and more graceful mould than the old *Industry* can boast of. She was at work up till 1862 but in that year got into collision and damaged herself so severely that it was not thought worth while to repair her. She was handed over to the Clyde Trust as a relic of bygone days, and has since been allowed to waste away without any very special preservative means being adopted. The numerous letters now appearing in the daily press may be effectual in moving the proper authorities to take steps for her preservation.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Inquiries for new tonnage are still far from numerous, but some of the leading firms on the Tyne have succeeded in securing a share of the very few orders that have come into the market. Messrs. Palmer have been lucky enough to obtain an order for two steamers of the largest class from a Liverpool shipowning firm, and the frame material is now being delivered. The firm stood much in need of this accession of work, for their large yard was nearly empty, and for many weeks past the great bulk of the operatives have been idle. Messrs. Wigham, Richardson & Co., of Walker, have also secured an order for a good-sized steamer, and as they have already a very large one in progress, the yard will be kept pretty busy for some time. Messrs. Hawthorn & Leslie have commenced the construction of a sample torpedo boat for the Spanish Government. It is understood that if the boat proves satisfactory an order for a considerable number will follow. Messrs. Armstrong and Mitchell have put down the keel blocks at their Elswick yard for a cruiser of considerable size, and they have also laid the keels for two small vessels. This is an important addition to the prospective work of the establishment, as, previous to the laying of the keels and keelblocks referred to, only one berth was occupied. There is a rumour current that the firm have a large ironclad to build for a foreign Government, but there is as yet no direct evidence of the fact, and for the present, at all events, the statement must be taken with reserve. Important extensions are being carried out at the Low Walker yard, belonging to the firm, where the pressure of work continues to be quite exceptional. Messrs. Schlesinger & Davis have commenced the construction of a large vessel, and Messrs. Swan & Hunter have three vessels in various stages of progress. Shipbuilding operations have not yet been commenced at Messrs. Stephenson's new yard, Hebburn, but the frame material for the first vessel to be laid down is daily expected to be delivered. The firm are now constructing a jetty, on which is to be placed a shearlegs capable of lifting 100 tons. Messrs. Readhead have three berths occupied, each of the vessels that are in progress being of exceptionally large tonnage. A new graving dock, 387 ft. in length, was opened by the Tyne Pontoons and Dry Dock Company early in the month. The first vessel to enter was one of the Chinese cruisers recently launched from the Elswick yard. The cruiser was succeeded by a large cargo boat, which is being extensively repaired. The other repairing establishments on the river are being kept fairly supplied with work. The condition of the marine engineering trade is so dependent on the state of shipbuilding, that the amount of business doing in one industry may generally be taken as a fair index to the degree of activity or depression prevailing in the other. On the present occasion, however, this is not exactly the case, as the introduction of improvements in the structural arrangements of engines has induced many shipowners to supply their vessels with the more effective means of propulsion recently brought into use, and a larger proportion of work is thus provided for the engineering establishments than for the shipyards. It is therefore not surprising to find that throughout the north-east coast centres marine engineering is more active than shipbuilding, and this remark is not less applicable to the Tyne than to other districts. With reference to the two industries named, the relative positions just indicated are not only likely to be maintained, but more distinctly marked as time goes on; for however unwilling shipowners may be to enter upon a course which involves a large initial outlay, the exigencies of their business will compel them to keep pace with modern requirements. Work prospects in the locomotive branch are improving. Messrs. Hawthorn & Leslie have recently secured some good orders from home to Colonial railway companies, and their establishment at Forth Banks, Newcastle, is likely to become very busy. Messrs. Stephenson's locomotive works are much busier than they have been, and Messrs. Black & Hawthorn are also getting more work in this line. Other branches of engineering are slack, and in bridge building, boiler and tankmaking, &c., there is very little doing.

The Wear.—Increasing depression is unfortunately the feature of the local shipbuilding trade. Not a single order has been placed during the month, and no repair contracts of importance have been brought to the port. The fast passenger steamer *Lancashire Witch*, built by Messrs. J. L. Thompson & Sons, for the New Liverpool and Isle of Man Steam Navigation Company, had a most satisfactory trial early in the month, and subsequently left for Liverpool, from which port she made her first trip on the 7th inst. The vessel was only ordered in December, and independently of the careful regard to design and workmanship shown in her construction, the fact that she could be placed upon the station at the beginning of May cannot but enhance the reputation of the builders. It is understood that the firm contemplate making certain changes in the arrangement of their building berths, machine shops, &c., with a view to increase the general effectiveness of their establishment as a productive concern. To an outsider this would almost seem a supererogatory task, as it would be difficult to find a yard so admirably laid out, and so fully provided with facilities for carrying on work. Messrs. R. Thompson & Sons continue to get a very full share of such repairing work as is to be had, and during the month they have had several vessels in hand. The plating of a large vessel at their South dockyard has been commenced. At the Deptford yard a keel has been put down, but it is for a vessel ordered some time ago. There is another vessel on the stocks nearly framed, and two in advanced stages. Messrs. Doxford have nothing on the stocks but a torpedo boat, but Messrs. Short Brothers have two vessels in the framing and plating stages, and the keel laid for a third. Efforts are being made to form a company, to commence shipbuilding operations in one of the idle yards at Pallion, and dull as trade is, it is thought the efforts will be successful. The proprietorship of a local chain and anchor factory which has been idle for a long time has been reconstituted, and it is understood that operations will shortly be recommenced. In marine engineering there is no appreciable change. Mr. John Lynn, steam winch, windlass, and steering gear manufacturer, is having a good deal of work in hand, and has been kept busy during the whole of this year. Among other special contracts which this maker has been entrusted with this year were the steering gears for the passenger steamers *Lancashire Witch* and *Lake Ontario*, and the windlasses, &c., for the China Shippers Company's fine steamer *Moyune*. Messrs. Irving and Jopling, boiler and tank makers, Pallion, have been doing a steady business during the whole of the present year. This firm are the patentees and manufacturers of a new type of boiler known as the "annular," the chief merit of which is, that by its use a saving of at least 25 per cent. in fuel is effected. Messrs. E. and M. Douglas have been entrusted with the contract to supply new engines of a special type for the steam yacht *Iolanthe*. It may be mentioned that this very neat little vessel was built by Messrs. Irving & Jopling a couple of years ago.

The Hartlepools.—Messrs. W. Gray & Co., iron and steel shipbuilders, continue to have their stocks well filled, and the other two local yards are up to the present well provided with work. The Central Marine Engine Works are kept in steady operation, and the same may be said of Messrs. Richardson's establishment. Timber imports are now becoming pretty numerous, and an increased demand for labour at the docks has consequently arisen. Local cement works are keeping fairly well employed.

The Tees.—Messrs. Raylton, Dixon & Co. have two large vessels of a first class type on the stocks, one of which is plated. The plating of the other has just been commenced, and the firm are finishing the plating of a large vessel that has stood on the stocks in an uncompleted condition for many months. Messrs. Craggs & Co. are framing a vessel of medium size. Messrs. Pearse and Co., Stockton, have a large vessel ready for launching, and another of equal size in frame. The keel blocks are laid for a third vessel, which is also of more than the ordinary dimensions. Messrs. Taylor and Craig launched a vessel early in the month, and a sister ship is now in course of plating. Messrs. Richardson and Duck have several barges in various stages of construction. Messrs. Blair & Co., engineers, are fully supplied with work at present, and are employing almost as many men as at any former period. Messrs. Wrightson & Head have some important contracts in progress, and it is stated that another large contract for bridge work has recently been secured. Most of the other engineering and bridge-building establishments in the district are able to keep in steady operation. The finished iron works are, if anything, slacker than they were a month or two ago, but at the different steel works there are still sufficient orders in hand to keep the machinery fully going.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Herongate.—On April 23rd there was launched from Messrs. Short Brothers' yard at Pallion, Sunderland, an iron screw steamer, built to the order of Messrs. Weatherley, Meade & Hussey, for the London and Dunkirk trade. Her dimensions are:—Length over all, 180 ft.; breadth of beam, 25 ft.; and depth of hold, 12 ft. 6 in. She will be fitted with triple compound engines of 80 H.P. by Messrs. Dickinson, of the Palmer's-hill Engine Works. The cylinders are 15½ in. by 25 in. by 42 in., and have a 24 in. stroke. The vessel has an open short poop, with bridgehouse for officers, and saloon and topgallant forecastle for the crew. The *Herongate*, as she is to be named, will have three large hatchways, and will be schooner-rigged.

Arete.—On April 25th there was launched from the shipbuilding yard of Messrs. William Pickersgill & Sons, Southwick, Sunderland, an iron clipper barque of the following dimensions:—Length, 237 ft.; breadth, 35 ft. 6 in.; depth moulded, 23 ft. 1½ in.; and constructed to Lloyd's highest class. She has been built to the order of Messrs. Thomas Rayner & Co., Newport, Mon., and has been fitted with cabin aft for the accommodation of the captain and officers. The apprentices' berths and mess rooms are also fitted aft, and a large iron house has been built for the accommodation of the crew, including carpenter's shop and galley, which contains one of Messrs. Brownlee & Co.'s (of Glasgow) patent condensers. Messrs. Harfield & Co.'s patent windlass has been fitted, while hand winches and capstan were supplied by Messrs. Rogers & Co., of Stockton, and screw steering gear by Messrs. Hastie & Co., of Greenock. As the vessel left the ways she was christened by Miss Meggie Pickersgill, sister of the builders, who named her the *Arete*. She has been superintended during construction by Mr. Henry Claughton, of Liverpool, who was also the designer of the vessel.

Crescent.—On April 25th there was launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, North Sands, Sunderland, a handsomely modelled steel screw steamer of the following dimensions, viz:—Length between perpendiculars, 284 ft.; breadth extreme, 38 ft.; depth moulded, 20 ft. 10 in.; deadweight capacity about 2,950 tons at 19 ft. 2 in. draught, with Lloyd's freeboard classed 100 A1 at Lloyd's. This vessel has been built to the order of Messrs. John H. Parry & Co., of Whitby, and is the eighth vessel built by this firm for the same owners; she is built on the web frame and longitudinal plate intercostal system, thereby dispensing with hold or orlop deck beams, has raised quarter deck, full poop long bridge, 118 ft., topgallant forecastle, iron deck, six iron bulkheads, five large hatchways, and and is fitted with all the latest improvements, viz:—Harfield's patent windlass, four large steam winches by Lynn, of Pallion, Copper's, steam and hand steering gear combined, and also Hastie's patent screw steering apparatus on the poop. The engines, which are of the triple-expansion type, are being built by Mr. John Dickinson, Palmer's Hill Engine Works, Sunderland, of 180 H.P., cylinders 21½ in. 35 in. 58 in., with a stroke of 39 in. Two steel boilers, 150 lbs. working pressure, will also be fitted with Dickinson's patent steel built crank shaft and Blake's donkey boiler. This vessel is intended for the general carrying trade, and has been fitted up in every respect to meet the requirements of the Grain Cargoes' Act of 1880. A large company was present to witness the launch, and as she left the ways she was gracefully christened *Crescent* by Miss Reed, of Sunderland, daughter of one of the owners. When completed the vessel will load outward cargo for the Mediterranean, and be commanded by Captain Wm. Jefferson, late of the s.s. *Larpool*, of Whitby.

Hopetoun.—On April 25th the steamship *Hopetoun*, a steel vessel built by the Palmer Shipbuilding Company, was launched from the stocks at Jarrow. She has been built for general merchant service to the order of Messrs. Wright & Co., London. The *Hopetoun* is classed 100 A1 at Lloyd's, and will be engined by the firm for developing 200 H.P. Her length between perpendiculars is 255 ft., breadth of beam 37 ft. 6 in., depth moulded 21 ft. 8 in., depth of hold 20 ft. 2 in. She has a long raised quarter-deck, and a bridge extending to the foremast, a topgallant forecastle, steel decks, and cellular bottom for water ballast. Captain Freeman and Messrs. Menzies and Blackburn, Newcastle, have superintended the construction on behalf of the owners.

Achille Adam.—On April 27th a twin-screw steamer by Samuda Brothers, Limited, was launched from their shipbuilding

yard at Poplar. This vessel has been constructed for the South Eastern Railway Company for service between Folkestone and Boulogne. She is intended chiefly for cargo purposes, but has accommodation for a few passengers. She is built of Siemens' steel and is 190 ft. in length, 27 ft. in breadth, and 12 ft. in depth. Her engines are of the compound type, of 600 I.H.P., by Messrs. Maudslay, Sons and Field. The vessel was named the *Achille Adam* by Miss Burrows, daughter of the chairman of Samuda Brothers. After the launch the vessel was taken to the Millwall Dock to receive her machinery.

Sodium.—On April 27th Messrs. Wood, Skinner & Co., Bill Quay, Shields, launched from their yard a steel screw steamer, built to the order of the Newcastle Chemical Works Co., Limited. Her principal dimensions are:—100 ft. by 20 ft. by 8 ft., with a deadweight carrying capacity of 190 tons. The vessel has been built under Lloyd's special survey for the 100 A1 class, and will be fitted with compound engines, 14 in., 26 in., and 18 in. stroke, by the Wallsend Slipway and Engineering Company, Limited. The vessel has been specially designed for the Company's coasting trade. As the vessel left the ways she was christened the *Sodium* by Mrs. Edward Davidson, the wife of the secretary of the Company, and immediately after the launch was towed to the Wallsend Engineering Company's Works to receive her machinery.

Lydie.—On May 7th Messrs. Edward Withy & Co., West Hartlepool, launched an iron screw steamer named *Lydie* from their yard. The vessel has been built to the order of Messrs. Burdick & Cook, of London, and will carry a large deadweight cargo. She has a long raised quarter deck with a short raised poop, long bridgehouse and topgallant forecastle, and is fitted with double bottom for water ballast on the McIntyre principle. The vessel has four watertight bulkheads and the main, quarter bridge and topgallant forecastle decks, bulwarks and rails are of iron. She is fitted with Blake's patent donkey boiler, four steam winches and patent windlass by Clarke, Chapman, Parsons & Co., patent hand and steam steering gear amidships by Davis & Co., Hastie's right and left steering gear aft, and Wasteneys Smith's patent stockless anchors hauling up into hawse pipes. The saloon for the use of passengers, captain, and officers, is finished in polished hardwood. Elegantly painted panels, executed in oils in the most pleasing and effected style, are ranged along each side of the saloon, the design and execution being by the decorative staff employed by the builders. The vessel is rigged as a two-masted fore and aft schooner with iron pole masts, and is built under Lloyd's special survey for the 100 A1 class, and under the personal superintendence of Mr. Cook. She will be fitted with triple-expansion engines of 155 N.H.P. by Messrs. Blair & Co. of Stockton-on-Tees. On leaving the ways the vessel was gracefully christened *Lydie* by Madame Octave Letellier. The builders, after entertaining the owners and their friends to luncheon, amongst whom were Mr. and Mrs. Burdick, Mr. and Mrs. Cook, Mons. and Madame Cocquerel, of London, Mons. and Madame Letellier and Mons. Jules Letellier, of Paris, Mr. and Mrs. Furness, Mr. and Mrs Withy, Mr. and Mrs. Vick, Miss King, Mr. W. Nicol, and Mr. P. B. Blair, at the Royal Hotel, West Hartlepool, drove them to Stockton-on-Tees.

Taal.—On May 7th there was launched from the the shipbuilding yard of Messrs. W. H. Potter & Son, Queen's Dock, a handsome steamer of the following dimensions:—Length, 150 ft.; breadth, 22 ft.; depth of hold, 9 ft. The vessel was gracefully christened the *Taal*, as she left the ways, by Mrs. J. Carlton Stitt. The steamer has been built to the order of Don Francisco L. Roxas, of Manilla, and under the supervision of Mr. Thomas Fawcett, of Manilla, and is constructed of steel to Lloyd's highest class. She is intended for passenger and cargo traffic in the Phillipine Islands, and is fitted with a shade deck for three-fourths of her length. Messrs. David Rollo & Sons, Fulton engine-works, who are the contractors for both the hull and machinery, are fitting triple-expansion engines of the latest type. The vessel and her machinery are built to the specifications and plans of Messrs. W. R. M'Kaig and J. Carlton Stitt, of Liverpool, consulting engineers on behalf of the owner.

Benholm.—On May 9th Messrs. Craig, Taylor & Co., of South Stockton, launched a new steel screw steamer for Mr. Joseph Hoult, Liverpool. This vessel is constructed with a bottom on the cellular principle, and is fitted with four large steam winches, patent donkey boiler, steel masts, Pepper's steam steering gear, Emerson's patent windlass, lighthouses, and all the latest improvements. She has a capacity for 2,500 tons of cargo. Accommodation for captain, officers, and engineers is on deck. Everything is arranged for the rapid shipment and discharging of cargo. She will be fitted with triple-expansion engines by Messrs. Carr and Co., Sunderland. Engines 18 in., 29 in., 48 in., by 36 in. stroke, with two boilers. She was gracefully christened *Benholm* by Miss Edith Taylor, daughter of Mr. Thomas Taylor, J.P., Oakwell Hall, Birstall, near Leeds. The vessel and engines have been constructed under the superintendence of Mr. A. C. Hay, the Company's superintendent, Liverpool. The builders have a similar ship also under construction for Mr. Hoult.

Haverstoe.—On May 10th this vessel was successfully launched from the yard of Messrs. William Doxford & Sons, at Pallion. She has been built to the order of Messrs. Bennett & Co., of Grimsby, for the general trades, but with special adaptability for their timber trade. She is entirely of steel, built to Lloyd's A1 class, with considerable additions, having double sheer and side plating and an iron centre bulkhead. The principal dimensions are:—Length between perpendiculars, 275 ft.; breadth, 39 ft. 6 in.; depth moulded, 21 ft.; with cellular bottom fore and aft. The engines are triple-expansion three cranks, with all Messrs. Doxford's latest improvements, the cylinders ~~being 21 in., 35 in.,~~ and 57 in. diameter respectively, and the stroke 39 in., and they are supplied with high pressure steam from exceptionally large boilers. She is fitted with Pepper's patent steam steering gear and Hastie's screw gear aft, and four winches by Messrs. Rogers, of Stockton. Lighthouses on forecastle and all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hardwood in the poop aft, and give most comfortable quarters for captain and officers and a few passengers. The christening ceremony was most tastefully performed by Miss Atkinson, daughter of H. J. Atkinson, Esq., M.P., and amongst the company present were Mrs. H. Bennett, Miss Kruger, Mr. J. Bennett, Jun., Mr. W. Bennett, Mr. F. S. Bennett, of Grimsby, and Mrs. W. T. Doxford, of Grindon Hall, and Mrs. R. P. Doxford, Sunderland. The machinery has been surveyed during construction by Mr. Jamieson, of Hull, on behalf of the owners, and the hull by Mr. Squires, and the vessel will sail shortly under the command of Commander J. C. Blenkhorn.

Sir W. T. Lewis.—On May 19th a new steamboat, which has been built for the Bristol Channel trade, was launched from the yard of Messrs. Elliott & Jeffrey, engineers and shipbuilders, West Bute Dock, Cardiff. The vessel is 110 ft. in length over all, 20 ft. beam, with depth of hold 11 ft. She is fore and aft schooner-rigged, has an iron bridge extending two-thirds of her length, and covered with wood fore and aft. She is furnished with a strong collision bulkhead forward and two aft, has two large ballast tanks aft, and bunker space is provided for 70 tons. As she is intended for use as a passenger steamer, as well as for tug purposes, a spacious saloon has been fitted up. The captain has been allotted a house on deck, while the crew will be berthed in the forecastle, which gives accommodation for 10 seamen. The engines are on the compound surface-condensing principle and of 80 H.P. nominal. There is also a powerful steam windlass forward. The boiler, which is double-ended and constructed of Landore-Siemens' steel, is 18 ft. long by 9 ft. 8 in. diameter, with four furnaces. From keel to truck, with all machinery, the ship has been constructed at Messrs. Elliott & Jeffrey's works. She has been built under Board of Trade supervision, with a view to carrying passengers, for whose convenience her sides will be covered in amidships. She will also carry a couple of boats. The mayoress of Cardiff christened the vessel *Sir W. T. Lewis*.

LAUNCHES.—Scotch.

St. Kilda.—On April 25th Messrs. John Reid & Co. launched from their shipbuilding yard at Port Glasgow the steel screw steam yacht *St. Kilda*, designed by Mr. St. Clare J. Byrne, of Liverpool, for Mr. Albert Wood, of that city. Her dimensions are as follows:—Length over all, 109 ft., beam, 18 ft. 1 in., depth, 11 ft.; tonnage, Thames yacht measurment, 142 tons. This yacht is schooner-rigged, and is fitted with triple-expansion three cylinder direct-acting surface-condensing engines, which are to work at 150 lbs. pressure. The engines are supplied by Messrs. Ross and Duncan, Whitefield Works, Govan.

Dinorah.—On April 26th a schooner of about 70 tons was launched from the yard of the Messrs. Fife, Fairlie. As she took the water she was christened *Dinorah* by Miss Mary Fife, a daughter of the builders. Her principal dimensions are:—Length between the perpendiculars, 70 ft.; beam, 15·5 ft.; and draught, 10 ft.; and she has been built to the order of Mr. J. B. Atkinson. She is to be commanded by Captain Mackenzie.

Thistle.—On April 26th the champion yacht *Thistle* was launched by Messrs. D. and W. Henderson, Meadowside,

Partick, Glasgow. The *Thistle* has been designed as a Clyde representative yacht to compete with the champion American yacht for the possession of the Queen's Cup, won at the Isle of Wight in 1881 by the United States yacht *America*. Mr. G. L. Watson, naval architect, is her designer, and she has been constructed for a syndicate of owners, headed by Mr. J. Bell, of Glasgow. She is constructed of steel, with clipper bow, and has the national emblem, a thistle, as her figurehead. Her dimensions are:—Length over load water-line, 85 ft.; breadth, 20 ft. 3 in.; depth of hold, 14 ft. 1 in.; tonnage (register), 100·5. The *Thistle* has a flare, which will be of great advantage in standing her enormous press of canvas. She has a clipper stem, and a considerable overhang of stem and stern, which arrangement will allow an exceptionally large mainsail. The sternpost shows good rake, and admits of easy quarters and a clean run. The hull up to the covering board is plated with steel. The frames are unusually strong; partial bulkheads give further strength to the *Thistle*. The sweep of the deck is easy, and the deck fittings give much room for working the heavy gear. Going to wind-~~ward through a bad sea~~ she will be rigged as a yawl. In crossing the Atlantic she will carry a cruising mainsail and big mizen. A month hence the *Thistle* will engage in her first race, an event which will be watched with no small interest by all yachting circles throughout the kingdom. This is the Southend to Harwich match of the New Thames Club, which will take place on May 28th. The *Thistle* will be commanded by Captain Barr, who sailed the *May* for Mr. A. B. Stewart, and who won a Queen's cup with *Aleria*, the only 10-tonner that ever achieved this distinction.

Bracadale.—On April 27th Messrs. Alexander Stephen & Sons launched from their shipbuilding yard a handsome four-masted iron sailing ship of about 2,000 tons gross register, of the highest class at Lloyd's, with extras beyond their requirements. She has been built to the order of Messrs. J. & A. Roxburgh, of Glasgow, to whose fleet she will doubtless prove a worthy addition. The accommodation for the captain and officers has been provided in the poop, while the apartments for petty officers and crew are in iron houses on deck. This vessel, which is provided with all the most recent appliances for working of ship and cargo, including steam winch, &c., was gracefully named the *Bracadale* by Mrs. J. H. Melville, Eriden, Falkirk, and will be commanded by Captain Peebles (late of the *Tweedsdale*). She is a sister ship to the *Armadale*, recently launched by the Messrs. Stephen for the same owners.

Sotileza.—On April 27th D. Macgill & Co., of Irvine, launched the *Sotileza* (s), constructed of Siemens-Martin steel. She is 100 tons register, and is of the following dimensions:—Length, 92 ft.; beam, 18 ft.; depth, 8 ft. 7 in. She is intended for the foreign trade.

Electra.—On April 28th Messrs. Russell & Co. launched from their Kingston yard, Port Glasgow, a twin-screw steamer of the following dimensions:—Length, 160 ft.; breadth, 27 ft.; and depth, 11 ft. 6 in. She has been constructed to the order of the Clarence and Richmond Steam Navigation Company of Sydney, and is intended for Australasian river traffic. Accommodation is provided on board for 46 first-class passengers and 60 second-class passengers. The vessel has a promenade deck aft. Her arrangements for general trading are most complete, and provision is made on deck for cattle carrying purposes. Accommodation for the first and second engineers is provided in a house aft, the captain's quarters being amidships, and the other officers' rooms aft. On leaving the ways the steamer was named the *Electra*, and she was afterwards towed to Greenock to be supplied with Rankin & Blackmore's patent twin-screw engines. The *Electra* is guaranteed to attain a speed of 11 knots. She will be fitted throughout with the electric light by Mr. Rankin Kennedy, Glasgow.

Vigilante.—On May 2nd Messrs. Murdock & Murray launched from their shipbuilding yard at Port Glasgow a steel screw-steamer, of the following dimensions, viz:—50 ft. by 12 ft. 6 in. by 5 ft. 6 in. This vessel has been built to the order of Messrs. David Rowan & Son, Glasgow, for Messrs. Wilson, Sons and Company (Limited), London. The engines (9 in. and 18 in. by 12 in. stroke) are being fitted on board by Messrs. Rowan; and on the vessel being completed she will sail out under canvas to Cape de Verde Islands, where she will be employed for towing purposes. This vessel is named *Vigilante*, and is a duplicate of the *Mosquito*, built by the same builders last year.

Choubrah.—On May 5th Messrs. Lobnitz and Co., launched at Renfrew a large twin screw hopper barge, built to the order of the Suez Canal Company. She is named the *Choubrah*, and is 135 ft. long by 25 ft. broad by 11 ft. 6 in. deep, measuring 400 tons, and is propelled by two independent pairs of compound engines to indicate collectively 300 H.P. After being launched, the *Choubrah* was taken to the builders' wet dock to receive her machinery, also constructed by Messrs. Lobnitz & Co.

Glenelgy.—On May 6th, the Ailsa Shipbuilding Company launched from their yard at Troon a steel yacht, named the *Glenelgy*, of the following dimensions:—Length, 71 ft.; breadth, 12 ft.; depth, 8 ft. The engines are to be supplied by Messrs. Kincaid & Co., engineers, Greenock.

Herald of Mercy.—On May 9th the Ailsa Shipbuilding Company launched from their yard at Troon a wooden mission ship, to the order of Mr. Henry Cook, Gosport, and intended for the Portsmouth and Gosport Seaman's Mission, for service in English and French Ports. She was built under special survey, and classed 12 years A1 at Lloyd's and measures 74. ft between perpendiculars, 19 ft. 6 in. broad, and 10 ft. 6 in. in depth. The vessel has the peculiarity of being ketch-rigged, and is provided amidships with a large hall for meetings, suitable for accommodating nearly 200 persons. The cabin for the missionaries is situated aft, while the crew are accomodated forward. As she left the ways she was named the *Herald of Mercy* by the Marchioness of Ailsa.

Victoria.—On May 9th the *Victoria*, the first of the magnificent additions to the Peninsular and Oriental Company's already large fleet, was launched from Messrs. Caird & Co.'s yard at Greenock. The *Victoria* is of a tonnage of 6,600 tons gross, and her engines give 7,000 H.P. The length of the ship is 465 ft. 9 in.; beam, 52 ft.; depth, 37 ft. She has triple-expansion engines with all the latest improvements, and in working up to her ocean speed of 16½ knots, will burn 110 tons net of coal per diem. She has six double-ended steel boilers with 36 furnaces, besides a three-furnaced auxiliary boiler for general purposes. The vessel's lines are at the entrance perfectly straight, and very fine; this is to enable the ship to be driven easily at sea, and to make good weather. She is also specially designed, always taking into consideration her size, for a light draught. She has water tanks, structurally built in compartments, designed for safety and for adjusting the trim of the vessel under varying conditions of lading, or when passing over a bar. From these particulars it will be seen that there has been a general design for comfort, speed, and convenience, without sacrificing too much to either necessity. The *Victoria* is a four-masted vessel, square-rigged on her two forward masts. She will be a large freight carrier, and is supplied with hydraulic hoists and cranes by Sir William Armstrong & Co., for loading and discharge of cargo, which, by their silent working, will not annoy passengers as with the ordinary steam winches. There is another important item in the construction of the ship, viz., large cargo ports, which, when opened at sea, will materially add to the comfort of the passengers in respect to light and ventilation. She is designed to carry 178 first-class saloon passengers, and 166 second-class saloon passengers; and so far as her passenger arrangements are concerned, she is intended to have the greatest amount of comfort, safety, and healthy arrangements that can be attained. To all old travellers in tropical seas, that which will approve itself as a prime necessity is good ventilation. In these vessels a mechanical system has been adopted, by which fresh air is forced through the ship and the vitiated air extracted; in the cabins, saloons, and 'tween decks the air can be changed up to six times in each hour, and the cargo spaces are similarly treated. The sleeping cabins, most of them having only two berths, are on the main deck; they have very large side lights, which can be always open except in the severest weather, the special design of the ship allowing them to be very high above water. On the spar deck are the dining saloons, that for the first saloon passengers being forward, and for the second aft. On the hurricane deck are the cabins for the captain and superior officers, the drawing rooms, lounge, and smoke-rooms. The ship is lighted throughout by electricity, for which purpose she has two engines distinct from other work, and duplicate dynamos, furnishing power for 500 incandescent lights. Of course there is plenty of bath accommodation and other sanitary arrangements, also hospitals in case of sickness. Arrangements are made for the carriage of a very large supply of fresh water, in addition to which the vessel carries two Normandy condensers. The safety of the passengers, crew, and ship has been a first consideration in designing the vessel, provision having been made to guard against fire by suitable sub-divisions, steam injection, and independent water service for powerful hand and steam pumps: also 12 boats, besides life-rafts, are carried, and

everything done to provide against sea and fire risk, even to that of placing a life belt beside each berth in the ship, and in all these appliances the crew are regularly drilled. The elaborate decorations have been designed by Mr. T. E. Colcutt. The structural designs and general arrangements have been passed by the Director of Naval Construction, so that the vessel may be employed in case of need as a fast cruiser. In addition to the *Victoria* the Peninsular and Oriental Company are also building at Greenock, the *Britannia*, of nearly 7,000 tons, and at Messrs. Harland & Wolff's yard, at Belfast, the *Oceana* and *Arcadia*, of the same dimensions as the *Victoria*, and these four steamers are being constructed for the India, China, and Australian mail services of the company. When launched the *Victoria* ran on to the bank opposite Greenock, and, although seven steam-tugs tried to get her off, she did not move. She was floated off the following day by the combined efforts of six powerful steam-tugs.

Grande Riviere.—On May 12th the Grangemouth Dockyard Company launched from their shipbuilding yard a steel screw steamer, 150 ft. by 22 ft. by 10 ft. to main deck, 17 ft. to saloon deck, built under Lloyd's special survey for their 100 A1 class. This makes the third steamer built by the Dockyard Company this year to the order of Messrs. W. E. Roberts & Co., of Liverpool, for Gen. Riviere, of Hayti. The vessel is fitted up with all the latest improvements for working ship and cargo, and has large accommodation for passengers. In taking the water the vessel was named *Grande Riviere* by Miss Jeanie Miller, daughter of one of the builders. The three vessels, named *Nouvelle Voldrogue*, *Manoel*, and *Grande Riviere*, are intended for the passenger and cargo coasting trade among the West Indian Islands, and to carry the mails and Government despatches. The machinery is being supplied by Messrs. Dunsmuir & Jackson, Glasgow.

County of Linlithgow.—On May 13th the four-masted sailing ship *County of Linlithgow* was launched from the shipyard of Messrs. Barclay, Curle & Co., Limited, Whiteinch, and thereafter towed to the harbour to be completed. She has been built to the order of Messrs. R. & J. Craig, of Glasgow, for their county line of ships trading to Calcutta and the United Kingdom. On moving on the ways she was named in the customary manner by Miss Cowan, Okel Bank, Alva.

Moselle.—On May 14th Messrs. Archibald M'Millan and Son launched from their dockyard at Dumbarton, a steel screw steamer of about 400 tons register, named the *Moselle*. This vessel, which obtains the highest class at Bureau Veritas, has been constructed to the order of Messrs. N. Paquet & Co., of Marseilles, for their Armenian coasting trade, and is of the following dimensions:—145 ft. by 22½ ft. by 10 ft. She is to be fitted with triple-expansion machinery, of sufficient power to propel her 12 knots per hour, by Messrs. Scott & Co., Greenock, and have all modern improvements for economy and efficiency. The vessel was named by Mrs. R. S. Cumming, of Dumbarton.

Cruban.—On May 17th Messrs. John Reid & Co. launched from their building yard, Port-Glasgow, the steel s.s. yacht *Cruban*, for Mr. John Neilson, of Glasgow. She is 61 ft. long over all, 55 ft. B.P., 10 ft. 6 in. moulded beam, 6 ft. 6 in. moulded depth, and tonnage 27 T.Y.M. She is fitted with a saloon at the after-end, a dining saloon forward, and the crew's accommodation in the fore-end. A steam capstan for heaving the cable and trawl lines has been fitted forward. She steers by wheel from amidships, and has starting and reversing gear on deck, immediately in front of the wheel. Her engines are supplied by Messrs. Ross and Duncan, of Govan, and are compound surface-condensing, cylinders 6½ in. and 12 in. by 8 in. stroke, supplied with steam from a horizontal marine boiler at a pressure of 100 lbs. per square inch.

Albania.—On May 18th Messrs. A. M'Millan & Son launched from their Dockyard, at Dumbarton, the steel screw steamer *Albania*, sister to the *Ionia* and *Thrace*, both launched a few weeks since from the dockyard. These vessels are to form additions to the Greek Royal Mail and Passenger Steamship Line, trading throughout the coasts of Greece and adjacent seas, and are very handsomely fitted up for a large number of first and second class passengers, and are to be furnished with all modern improvements for comfort and economy. The *Albania* is of the following dimensions:—Length 265 ft., breadth 34 ft., depth 21 ft., tonnage gross register, about 1,500 tons. The machinery, which is on the triple-expansion type, of 1,700 I.H.P., is by Messrs. D. Rowan & Son, Glasgow, and capable of propelling the vessel at a speed of 13 knots.

Hirondelle.—On May 18th Messrs. Hanna, Donald & Wilson, Paisley, launched from their yard, on the banks of the river Cart, a 28-ton steel-built steam yacht, named the *Hirondelle*. Her dimensions are:—Length over all, 73 ft. 6 in., between perpendiculars 64 ft., beam 10 ft. 9 in., depth 6 ft. 6 in. She is supplied with compound triple-expansion surface-condensing engines, constructed by the same firm, and it is expected a good rate of speed will be attained. She is handsomely furnished, and fitted with electric light throughout. After coaling she was taken down the Cart.

Steam Yacht.—On May 19th Messrs. Hanna, Donald & Wilson launched from their yard on the Cart, at Paisley, a little steel-built steam yacht, of the following dimensions:—Length over all, 73 ft. 6 in.; between perpendiculars, 64 ft.; beam, 10 ft. 9 in.; and depth, 6 ft. 6 in. She is supplied with compound triple-expansion surface-condensing engines, made by the same firm. It is anticipated a good rate of speed will be attained.

Dean.—On May 21st a steamer named the *Dean*, built for Messrs. George Armitstead & Co., was launched from the yard of Messrs. Gourlay Brothers, Dundee. She is 1350 tons register, measures 244 ft. in length, 34 ft. in breadth, and 18 ft. in depth, and will have engines of 140 H.P. She is intended for the Baltic trade, and will be commanded by Captain Taggart.

LAUNCH.—HONG KONG.

Composite Screw Steamer.—On Sunday, April 10th, there was launched from the shipbuilding yard of Messrs. Geo. Fenwick and Co., Praya East, a composite screw steamer for the Tonkin River Mail Service. This steamer is the first of five light-draught steamers now being built in Hong Kong to the order of Messrs. Marty and d'Abbadie, three of which are nearing completion at the Kowloon Docks. The dimensions are as follows:—Length over all, 120 feet; beam, extreme, 24 ft.; depth, moulded, 8 ft. The draught, when the steamer is fully loaded, will be 5 ft. These boats have been specially designed and constructed to meet the requirements of the river service in Tonkin. The frames and beams are entirely composed of steel, while the planking, decks, and other erections are of teak. The houses on the upper deck are similar in general arrangements to those of the Canton river steamers, the saloon forward being luxuriously fitted to accommodate 28 first-class passengers, four private cabins opening abaft this in a well-ventilated alley-way or passage. Amidships are the bath-rooms, lavatories, kitchens, &c., &c., while right aft, behind a large staircase, is a large saloon for native first-class passengers. The main deck has ample space for deck passengers, having movable screens all round as protection from sun or rain. The composite boats will be fitted with Messrs. Fenwick & Co.'s direct acting compound surface-condensing engines, 16 in. and 32 in. cylinders and 18 in. stroke. The boilers are fitted with Fox's patent corrugated furnaces and are built to Board of Trade and Lloyd's rules to carry a pressure of 100 lbs. per square inch, at which it it expected a speed of ten knots per hour will easily be obtained. A donkey boiler is also fitted in the stoke-hole to supply steam for fresh water condenser, steam-windlass, and cargo cranes. It is expected the first steamer will be put on the Haiphong-Hanoi line within two months. The steamers are being constructed under the superintendence of Mons. Lerede, Capitaine d'Armament, and Mr. W. C. Jack, superintendent engineer, to whose plans and specifications the steamers are being built.

TRIAL TRIPS.

Paris.—On April 22nd the s.s. *Paris*, which has been built by Messrs. C. S. Swan & Hunter, of Wallsend-on-Tyne, was taken on trial with very satisfactory results, the speed being nine knots loaded. The dimensions of the vessel are 162 ft. by 25·2 ft. by 9 ft. 9 in. The engines, which have been fitted on board by Messrs. Westgarth, English & Co., of Middlesbrough-on-Tees, have cylinders 13½ in., 22 in., and 36 in. diameter, by 24 in. stroke, 150 lbs. working pressure; I.H.P., 364. The *Paris* has been built to trade to Paris, and is fitted with lowering masts and funnel to pass under the bridges.

Fatshan.—On April 23rd the beautiful-modelled Chinese saloon steamer *Fatshan*, 2,260 tons gross, which has been built by Messrs. Ramage & Ferguson, Leith, for the Hong Kong, Canton, and Macao Steamboat Company, went for her trial trip down the Firth of Forth. The steamer, which has been specially constructed for the night passenger and general service on the Pearl River between Hong Kong and Canton, has been built in a most unique style.

The vessel has three decks, and her height from the keel to the uppermost or promenade deck is 33 ft. Her length is 280 ft.; breadth, 54 ft.; and depth of hold, 11 ft. 6 in. While standing in the water her appearance at first sight reminds a casual onlooker of the immense steamers which ply on the American Rivers. Owing to the Pearl River on which the *Fatshan* is to ply having been rendered almost unnavigable in consequence of the Chinese having, during the French invasion, thrown large quantities of rubbish and stones into the bed to prevent the fleet of the latter getting up the river, everything had to be done to ensure a light water draught, notwithstanding the immense size of the vessel. Through the ingenuity of the builders, however, this difficulty has been successfully overcome, and the structure only draws about 7 ft. 6 in. This result has been obtained through constructing the steamer of very light steel throughout. All the supports of the decks are hollow, and the plates are extremely thin. In case the steamer should ground and receive damage to the keel, the vessel has been provided with a double bottom. As some parts of the Pearl River is very shallow, it has been estimated that, notwithstanding the steamer's very light draught, her keel will at times be within 7 in. of sand. Pirates have on various occasions, when there has been valuable specie on board, invaded steamers on the Pearl River, and, after massacring the crews, have taken possession of valuable cargoes and lightened the passengers of their jewellery and money. In view of the well-known maxim that prevention is better than cure, the stairs leading to the various decks have at the top been fitted with iron gratings which can at once be closed down, and the robbers kept in the part of the ship which they first favour with their attentions. Separate portions of the steamer are set apart for European, Chinese, and Parsee passengers. This is considered essential, as the Parsees, who are looked upon as the Jews of China, will not associate with any but their own caste, in fact rather make themselves as disagreeable as possible to outsiders. All the cabins and dining saloons have been beautifully upholstered, and there are baths with hot and cold water in connection with the sleeping berths. The sleeping berths will accommodate about 3,000. While every attention has been paid to the comfort of passengers, the crew, which will be composed of Chinese, is not forgotten, for beautiful lavatories and baths are fitted for the use of the men. In fact it may be looked upon as a slur on British vessels, when the great attention paid to the requirements of the crew on board those Chinese steamers is considered. All the lamps on board are lighted by electricity, and the principal steering wheel is fixed at the very prow of the steamer on the uppermost deck. Of course, although this may be looked upon as rather uncommon, it is essential, for the navigation of a river like the Pearl, that the vessel should be guided from the foremost part. The promenade deck floor is covered with canvas, and will admit of as many as 2,000 passengers taking an airing at the one time. There is a fine awning extending over the promenade which will shelter passengers from the rays of the sun or a shower of rain. The electric light has been fitted up thoroughout the steamer, and, with the exception of the funnel, the whole of the vessel has been painted white. The engines are triple-expansion, having cylinders 17, 27, and 42 in. in diameter respectively, by 24 in. stroke, the I.H.P. 1,200, and steam is supplied from two boilers 13 ft. 6 in. in diameter by 10 ft. long, each boiler having three Fox's corrugated furnaces, with a working pressure of 150 lbs. per square inch. The speed guaranteed by the builders was 11 knots per hour, but on the trial trip the steamer did 12½ knots with ease. A number of the owners, who are nearly all British gentlemen, were on board, and expressed themselves as highly satisfied with the steamer's first performance.

Abbas.—On April 27th the twin-screw hopper barge *Abbas*, built by Messrs. Lobnitz & Co., Renfrew, to the order of the Suez Canal Company, for use in the widening of the canal, went on her trial trip in the Firth of Clyde. The result of the full speed trials showed that a mean speed of 8½ knots had been attained, and the trial generally was considered satisfactory. After the trial trip he compasses were adjusted, and the *Abbas* proceeded on her voyage to Port Said.

Nederland.—On April 27th the *Nederland*, a new steel paddle steamer built by the Fairfield Shipbuilding and Engineering Company, Limited, to the order of the Zeeland Steamship Company, of Flushing, went down the Clyde on her preliminary trial. The *Nederland*, which is to be employed in the night service about to be inaugurated between Queenborough and Flushing, is the seventh steamer built by the Fairfield Company for this line of steamers, and is similar in construction to the *Deutschland* and *Engeland* only recently built. Her principal dimensions are:— Length, 286 ft.; breadth, moulded, 35 ft. 3 in.; depth, moulded to upper deck, 23 ft. 3 in.; with a gross tonnage of about 1,700 tons. She is constructed to meet the highest requirements at Lloyd's for Channel service, and is fitted with every accommodation for passenger traffic. On the upper deck aft is a large house containing a spacious deck saloon, smoking-room, entrance to lower saloons, and six state-rooms, two of which can be used *en suite* if desired, and are fitted up in a superior style for the use of more distinguished travellers. The height 'tween decks in the after part of the ship is unusually high, being 9 ft. The dining saloon is just below the deck saloon, from which light and air are admitted through a large oval well. Aft is the ladies' saloon, and on each side of the staircase spacious lavatories are provided. The first-class saloons and smoking-rooms are all finished in hardwood, and the panels of the deck saloon are handsomely decorated with mirrors, and paintings by Dutch artists. An awning deck, extending from the after cargo hatch to within a few feet of the stern, affords a promenade for passengers. The second-class accommodation consists of a large room extending right across the ship, with ladies' room adjoining. Mail-room and officers' state-rooms are abaft of the second-class saloon, and the crew, firemen, &c., are berthed at the extreme fore end of the vessel. The vessel is driven by a pair of compound oscillating engines, with surface condensers. The cylinders are two in number, the high-pressure 60 in. and the low pressure 104 in. diameter, adapted for a stroke of 7 ft. The paddle and intermediate shafts are of steel, and the paddle-wheels have steel floats on the feathering principle. The total heating surface of the boilers, which are four single-ended cylindrical tubular boilers, is about 8,000 square ft. and the working pressure 30 lbs. per square inch. The steamer is fitted throughout with the electric light by Messrs. Andrews, of Woodside, there being 135 Swan incandescent lamps, and two arc lights for erection on the mast-head. The electric current is generated by one of Andrews's patent compound dynamos, which is driven by an engine of 22 H.P. The the trip on the 27th April extended as far as Ardrossan, and the vessel attained a maximum speed of 19½ knots. In the course of the day dinner was served in the dining saloon. Mr. E. D. Bryce Douglas, one of the directors of the Fairfield Company, occupied the chair, and among those present were Messrs. W. J. Pearce, D. R. M'Gregor, Van Woelderen, director of the Zeeland Steamship Company, A. Van Rijn, superintending engineer of the company, Captain H. Helliners and A. Heise, of the North German Lloyd's, Christophe Andreae, Mr Sanderson, Lloyd's surveyor, Colin Scott, N. A. Muir, and P. Joha, master of the *Nederland*. The chairman, in proposing the toast of "success to the Zeeland Steamship Company," said this was the seventh ship which the Fairfield Company had built for the Zeeland Steamship Company in eight years. The first set of four vessels were employed in the day Channel service, and had been so successful that they had paid off all the debentures of the company and their other debts, and not only that, but out of the profits three new ships had been built. The night boats were superior to anything else on the Channel service, and, their success having been assured, a day service was about to be inaugurated, for which he prognosticated as successful a future. It had only to contend, he said, with a wretched little line from Dover to Ostend. He might inform them that the journey from London to Cologne had been reduced from 20 to 13 or 14 hours' duration. Mr. Van Woelderen, in replying, expressed his appreciation of the efforts of the officials of the Fairfield Company in producing a first-class vessel, and proposed the health of Mr. Wm. Pearce, M.P., to which Mr. W. J. Pearce replied. The trip was concluded at the tail of the Bank about 5·30 p.m., and the *Nederland* thereafter got under weigh for Flushing.

Ocean King.—On April 28th the fine screw steamer *Ocean King* left on her voyage, after having her machinery converted to to triple-expansion, and new boilers, with a working pressure of 150. lbs. per square inch, fitted to her. The *Ocean King* is owned by Mr. William Ross, of London, and is a vessel of 2,449 gross tonnage. She is 350 ft. long, 36 ft. beam, and 25·6 depth of hold. Her engines as fitted when the ship was new were of the ordinary two cylinder compound type. The old cylinders have been removed, the bedplate has been extended, and a complete high-pressure engine erected at the forward end, two new cylinders having been fitted on the existing columns. The cylinders are now 26·42 and 68 in. diameter respectively, and all have a stroke of 48 in. The new boilers are two in number, each 12·9 by 16·6, with four of Fox's corrugated furnaces, and have been constructed to the requirements of the Board of Trade and Lloyd's, for a working pressure of 150 lbs. The vessel has had considerable

repairs to her hull, effected under the direction of Captain Denham, and has a large donkey boiler connected to extensive fresh water condensing arrangements, to suit her for the cattle trade, should she be required for the same. The contract for the above work was given to Messrs. David Rollo & Sons, Fulton Engine Works, on the 31st December, 1886, and, as the vessel left on Saturday complete in every detail, great credit is due to that energetic firm for having been able to complete such an extensive contract within four months. We may also state that the engines have been fitted with a new three-throw built crank shaft, 14½ in. diameter, and Messrs. Rollo and Sons have built and finished this shaft at their own works, which is more satisfactory than the usual method of entrusting such important work to outside forges. The cranks were shrunk to the shaft after heating by a mixture of gas and air. This is a great improvement on the old wood fire plan. On the way down the river the machinery was tested and gave great satisfaction, the engines working very smoothly at 60 revolutions per minute, the vessel's speed being about 11½ knots during the run. A number of gentlemen were on board, among whom were Mr. G. A. Milner (of Lloyd's), Mr. J. J. Mahon, Mr. G. A. Calvert, superintending engineer for the City of Cork Steamship Company; Mr. John Cassels, the company's engineer, under whose supervision the work has been carried out; Mr. A. J. Stunock, the company's representative; and Messrs. George & Malcolm Rollo, of the contractors' firm.

Sir John Jones.—On April 28th the official steam trial took place. This vessel is the first of two twin-screw mining steamers, constructed for H.M. War Department by Messrs. Cox & Co., Falmouth. These vessels are fitted with specially designed steam cranes and capstans, for the purpose of laying and recovering the mines and working the cables. They are 76 ft. between perpendiculars, 15 ft. 6 in. beam and 8 ft. 6 in. deep, and are fitted with two pairs of compound engines, cylinders 10 in. and 18 in. diameter and 14 in. stroke, and a steel boiler 90 lbs. working pressure. On trial the engines developed an average power of 171 collective, the speed being 10·1 knots. The *Sir John Jones* will shortly proceed to a working station on the East coast.

Magnetic.—On April 29th this vessel, belonging to Messrs. James Hay & Sons, Glasgow, went down the Firth for a trial of her machinery. The steamer has just received an extensive overhaul by Messrs. Aitken & Mansel, and had her compound engines converted to triple-expansion by Messrs. Walker, Henderson & Co. on their improved patent principle, an arrangement specially adapted for compactness and economy. The trial was in every respect more satisfactory, the mean speed of several runs on the measured mile being 12¼ knots. This is fully a knot more than that obtained from the old compound engines, while the consumpt showed a saving in fuel of nearly 50 per cent. The engines were severely tested as to their handling properties, and it was found with boiler pressure varying from 70 lbs. to 150 lbs. they were under perfect control, and that the vessel was capable of steaming 8½ knots per hour with the engines working at 70 lbs. pressure.

The Earl.—On the evening of May 5th a series of most interesting experiments were made with the machinery of the new iron twin-screw tug and salvage steamer, *The Earl*, built to the order of Sir William Thomas Lewis, of Cardiff, for the Bute Dock Estate, by Messrs. Edward Finch & Co., Limited, marine engineers and shipbuilders. The large centrifugal marine salvage pump first underwent its trial. This pump is capable of discharging from 2,800 to 3,000 gallons per minute, on a lift of 27 ft., drawing through five 6-in. bore suction pipes leading away from the tug to any place within the range of suction that it may be desired to clear of water. The suctions are made operative, simultaneously or otherwise, as required by means of Finch & Co.'s, improved quintuple sluice suction chest secured to the central intake of the pump, which is also fitted with an improved self-acting seal valve on its discharge. The salvage outfit is of an extensive description, consisting of steel galvanized pipes and bands, flexible rubber hose with steel nozzles, retention valves, &c., the whole having fastenings of the most approved description for the successful execution of salvage operations under all conceivable conditions. A few seconds after working the air ejector, the water rushed into the pump, which at once commenced to perform its maximum duty of passing 3,000 gallons per minute, the force with which the water came pouring out of the 13 in. discharge bearing witness to its volume as it dashed burying itself far into the depths of the river. After thoroughly testing the capabilities of the pump, the vessel steamed out of the river to run her official trial trip. She proceeded for a cruise down channel and then returned to Beachley Bay, and was there run at full power with and against the tide, the mean speed attained being 13½ knots per hour, the engines developing 514 I.H.P., and working most satisfactorily. On the vessel's return to Chepstow, her fire pump, one of the largest and most powerful extant, was put on trial, and through four long jet pipes sent up columns of water to a vertical height of 122 ft., at which heighth the jets burst into feathery clouds of mist. The combined pumping power of the two pumps for salvage work is about 275,000 gallons per hour, and without question the vessel will be a most valuable acquisition to the port of Cardiff, apart from its services as a fire float and tug.

Mancel.—On May 10th the s.s. *Mancel*, recently launched by the Grangemouth Dockyard Company, went down the Firth of Forth on her official trip. On the measured mile she attained a speed of 12 knots, being one knot in excess of that guaranteed. This vessel is the second of three steamers built to the order of Messrs. W. E. Roberts, of Liverpool, for General Reviere, Hayti, and is fitted up with all the latest improvements, and large accommodation for passengers. The Messrs. Roberts expressed themselves highly satisfied with the way in which their order had been carried out, and the vessel was generally admired by the company present. The vessel is intended for the coasting passenger trade of Hayti. The machinery was supplied by Messrs. Dunsmuir & Jackson, Glasgow.

Brampton.—On May 17th the new steel screw-steamer *Brampton* was taken to sea on her trial trip. The *Brampton* has been built by Messrs. John Readhead and Co., West Docks, South Shields, to the order of Messrs. Chapman & Miller, Newcastle-on-Tyne. Her dimensions are :—Length, 275½ ft.; breadth, 37 ft.; depth, 20 ft.; classed 100 A1 Lloyd's. She is of the improved well-decked type, having a full poop, long raised quarter-deck bridge extending forward of foremast. and topgallant forecastle. She is schooner-rigged, fitted with shifting boards and bulkheads to comply with the Grain Cargoes Act, and has a deadweight capacity of about 3,100 tons. She is also fitted with triple-expansion engines, also built by Messrs. Readhead, of the three-crank type, the cylinders of which are respectively 21 in., 35 in., and 57 in. diameter, with a stroke of 39 in. The steam is supplied by two steel boilers, single ended, each having three Fox's corrugated furnaces, at a pressure of 160 lbs. The engines worked with perfect smoothness at the time, no vibration being perceived, due to the equal distribution of the power over the three cranks, one of the many advantages of the triple-expansion engines. The compasses having been adjusted, the vessel was placed on the measured mile, and after a series of runs, the speed averaged 11½ knots, with an I.H.P. of 1,185 and 86 revolutions. This is the fourth vessel built for Messrs. Chapman & Miller by the above builders. The vessel was superintended during construction by Captain Ruthven and Mr. Strong, consulting engineer.

Queen Victoria.—On May 18th the paddle steamer *Queen Victoria*, built expressly for service between Liverpool and the Isle of Man by the Fairfield Shipbuilding and Engineering Co. (Limited), for the Isle of Man, Liverpool, and Manchester Steamship Co. (Limited), took her trials on the measured mile at Wemyss Bay, when one of the greatest successes in the records of steamship history was attained. On six runs at the measured mile, with the engines making 45 revolutions per minute, a result of 21 knots, or 24·2 miles per hour was obtained. Continuous steaming at this speed was kept up for nearly three hours, during which time the vessel turned half circles to starboard and port, with the helm over at 30 degrees, when it was found that she could turn in a semi-circle about 400 yds. radius. The forced draught, which is fitted to all the furnaces, was used at short intervals during the trial, as it was found unnecessary to use it continuously to get the speed achieved. The vessel was extremely steady, little or no vibration being felt. The straightness of her course during the trials was the admiration of those on board, a great help to this being the excellent steam steering engine specially designed and fitted by Messrs. Muir and Caldwell, Glasgow. The fittings of this ship are most complete in every respect. The arrangements for the comfort of passengers, both in the first and second-class quarters, are most complete and carefully planned. Elaborate arrangements for saving life in case of accident have been made, and are as recommended by the recent Commission. Boats, as per Board of Trade requirements, are slung in the ordinary davits. Collapsible boats are hung under the skid beams. Deck seats expand and form large lifeboats. All portable seats are wholly of wood. Large cushions of cork, innumerable life-belts and buoys are placed in every accessible part of the ship. Altogether, this ship is one of the most complete and perfectly-fitted passenger steamers which has ever been built on the Clyde.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—For the last time, I trust, on this subject, I crave a little of your space to answer the uncalled for and unseemly strictures which appeared in your columns of May last, on the subject-matter of my previous letter.

That any man in his senses, and who took the trouble to read my letter, can believe that I intended to cast a *slur* of any kind on a profession to which I myself belong, is beyond my power of conception. Can there really be people who seriously believe that it is better a man should continue in a fault than that his self-love should be wounded? I am disinclined to believe it. To produce further argument, or to cite authority to prove my position, will, judging from the past, be an unthankful business. But I am grateful to "Hon. Chief Secretary" for his expressions of sympathy on my behalf—elicited no doubt at the terrible onslaught of the "Uneducated Engineer." I therefore hasten to assure him that personally "my withers are unwrung." Yet I cannot but think that the "letting down" process which he seems to admire is a grievous and uncalled for letting down and exposure, not of me, but of the seamy side of our profession. Although a man need not necessarily be ashamed of his ignorance (when it arises from no fault of his own) he decidedly ought to be *ashamed of openly despising knowledge*; and that such sentiments should receive anything approaching to approval, is enough to make one really believe that "our civilization is a failure."

"An Uneducated Engineer" indignantly asks in his letter, "of what use are they (the sciences) to the class of marine engineers that is required at the present day." And another correspondent describes the sciences as giving a "superficial polish" only. Now, Sir, in the face of this, we have the following facts:—That the machinery of steam vessels is growing more and more complex every day. We have triple and quadruple expansion main engines; entirely new types of valve gearing; we have vastly augmented pressures; we have electric lighting and electric communication; we have hydraulic cargo gear; we have closed stoke-holes and forced draught; we have elaborate ventilating apparatus; we have refrigerating gears; we have petroleum carrying steamers, and shall probably soon be burning petroleum in our boiler furnaces. All these things and many more we have. Yet, in the face of them, a man can ask such an absurd question. If we do not soon bestir ourselves along the lines I have indicated, the inexorable law of "the survival of the fittest" will soon sweep many of our class from the contest; whilst many others will discover, when too late, that that amount of knowledge which insures intelligent action is appreciated more than they ever dreamt of. I maintain, Sir, that a man has no right to call himself an engineer unless he has such intelligent knowledge based on scientific principles.

By what principle of criticism it should be assumed that I am either a young man (*vide* Hon. Chief Sec.), or of the "crutch and toothpick" order (*vide* Mr. Rich. A. James Cope), I am at a loss to understand. I am inclined to think that a close inspection of my *propriâ persona* would materially modify their views in this respect.

The letter of Mr. Richard A. James Cope, working marine engineer, and *revêtu* order Leopold 2nd class, is quite too absurd to call for any serious comment. A man who talks of *rubbing out a deficiency, i.e.*, rubbing out a non-existent thing, and who calls science, which is the very basis and foundation of all mechanical knowledge, "superficial polish"; who deliberately recommends to men of our profession the study of Continental languages in preference, is either, to use an expressive phrase, "lame under the hat," or more ignorant than a charity boy. Judging from his letter, I should conclude that a little "superficial" study of the grammar of the English language would be desirable before he proceeds further with those of other countries. As to his absurd personalities—*chacun à son mauvais goût, mais prenez garde de tombre mon cher monsieur.*

In the MARINE ENGINEER for February, 1885, appeared a paper on "Marine Governors," by Mr. T. G. Barron. Now I have no knowledge whatever of Mr. Barron, nor am I known to him, but I consider his paper a very creditable performance, and one of which we, as a body, should feel proud. But what is the fact, and the very significant fact too, to my mind—why in the very next number the paper is violently attacked, and the author derided. And why? Because Mr. Barron dared to offer good advice to his brother engineers. Yours truly,

EXCELSIOR.

To the Editor of THE MARINE ENGINEER.

SIR,—It is with unfeigned satisfaction and pleasure, that I congratulate you on the good which has resulted from the ventilation in your columns of matters of vital importance to us marine engineers. Our grievances have been clearly set forth, their existence is no longer unknown, and it must be confessed we have been a long suffering and patient people. To allow the present anomalies of our position to continue to run on would be positive imbecility.

We have the remedy in our own hands. The remedy will be found in the formation of an Institution or Association of Marine Engineers of a character able to exert power and influence sufficient to exact respect from directors of large companies, shipowners and managers. Then, and not till then, shall we have our grievances redressed, our position improved and established, and all reasonable demands granted. Need I say that we, who have great interests at stake, who have much to strive for, must make a determined and successful effort to establish an institution capable of guarding the interests of and obtaining for its supporters substantial benefits. I hold that marine engineers ought to be capable in themselves of forming and supporting a society of weight and influence.

Permit me to tender a few suggestions:—Let the projected new association be styled "The Institution of Marine Engineers." Let its aim be lofty and ambitious. Though its earliest efforts should fall somewhat short of the goal yet may we be able to console ourselves with the reflection that if our aim had been less lofty we had probably not soared so high, nor reached the altitude arrived at in a first essay. I would further suggest that some man of note of great parts, and brilliant attainments like Sir W. G. Armstrong, Bart., or a leading man of the day, of standing and repute, of the stamp of Lord Charles Beresford or Lord Brassey, be asked to extend his patronage and support to the undertaking, which would greatly benefit by a protecting influence of a potent and distinguished nature. Let all its office bearers be chosen with great care and discrimination. Let its affairs be managed by a council composed of engineers of undoubted worth, position and experience in ocean-service; and let every effort be made to secure as supporters and members of the Institution engineers in the employment of all the leading mail and steamship companies. The P. & O. alone could furnish 250 supporters; several others might contribute treble figures, and there are a score of other companies whose engineers would benefit by supporting an institution whose sole object would be the furtherance and maintenance of the best interests of its members. Let no selfish motives deter the engineers of such services as the Cunard and P. & O. from subscribing liberally towards the defrayment of expenses incidental to the formation of a creditable institution. Let them step forward NOW and put forth all their strength in so laudable a cause as the building up of an institution destined, I hope, to become in all respects worthy of them and the cause; and, above all, let them bear in mind that the introduction of an influential and highly respectable element in its formation, will do much towards strengthening the hands of, and encouraging its promoters in their noble efforts. There is not the slightest reason to suppose that the establishment of an association which shall sink into a species of trades-union, with an attitude and policy more or less aggressive, is here under contemplation. Therefore it behoves every ocean-going engineer, possessed of a knowledge of the true interests and the pressing wants of his class, to do his utmost in aiding AT THE OUTSET a project from which he must speedily reap great benefit and undoubted gain. Nothing but the want of proper support can hinder an institution such as I picture, and if judiciously managed, from becoming widespread in its influence, universal in its sphere of usefulness, and worthy of the engineering profession generally. The present is an age of engineering triumph and renown. Everywhere is the influence of the engineer felt, and in no quarter more so than on board the modern

steamship. Let us, then, be up and doing. Let us take advantage of our influence to exact the respect due to it; then the proper recognition of our worth and position as officers of the first magnitude on board steamships will come as a natural sequence. The man of purely nautical standing has had his day. He must be made subservient to the man of steam, of science, in fact the man of the age. It is a slur on the engineering profession that its members afloat should hold a position so manifestly absurd and grossly unjust in the extent of its inadequacy. I scarcely think that the majority of the engineers in the leading mailship services will support any association likely to prove incapable of exacting from the directors of great companies that respect which trade-unionism (in its generally accepted sense) notably fails to command at the hands of shipping magnates. These men, it must be granted, are ENGINEERS, and like their brethren of the Imperial Service, require and will fight for INCREASED STATUS. An institution based to some extent on the lines I have imperfectly laid down would, I daresay, meet with their approval and support. Some of the suggestions of "Excelsior" are sensible and practicable. His method, by every legitimate channel, of making known to all interested in the formation of the institution its aim and object is well worthy of consideration. I pen these lines abroad, and in ignorance of what steps have been taken towards carrying out in a practical way the suggestions of the correspondents in the March number of your journal. I have now only to add that I will take the earliest opportunity of acquiring full information regarding the organization of the new Association of Marine Engineers. In conclusion, I wish to state my deep sense of the generosity and sympathy which prompt you in the opening of your columns to the full and free discussion of the many disabilities under which we labour, but which I sincerely trust, thanks to your invaluable assistance, are in a fair way to be entirely removed.

I hope soon to see your journal published fortnightly or weekly, and I wish it the liberal support to which its worth justly entitles it.

Yours faithfully,
ENGINEER OF A MAILSHIP.

20th March, 1887.

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—It was with feelings of pride and gratification that I perused the correspondence on this subject in your last issue, and it must have aroused similar feelings in our numerous sea-going brethren who habitually read your journal, upon finding that we possess in our ranks so many able and accomplished writers as "W. F. O.," "Veritas," "Excelsior," and Mr. Copé. If anyone should be rash enough to assert that marine engineers are incapable of managing their own affairs, or of stating their many grievances in language fit for publication, the letters of these gentlemen furnish abundant and most convincing evidence of the utter falsity of such an assertion; and although these correspondents are comparatively few in number, they are by no means exceptional, for my own opportunities for observation enable me to state that, especially among our rising engineers, there are scores of men fitted alike by education, ability, and natural courtesy of manner, to occupy and adorn the highest positions in society. The subjects treated of by your correspondents are very varied, and provide so large a field for comment, that it would be impracticable, in the space you could afford, to even notice them in detail, but knowing the deep interest taken in some of these subjects by the majority of our brethren, I must plead that as my apology for again availing myself of your kind courtesy, by making a few brief remarks thereupon. "W. F. O." very justly complains of the unfairness of permitting the engine drivers of steam yachts to count their time as genuine sea service, and it may interest your readers to learn that this subject has already been taken in hand and partly discussed with the head of that department of the Board of Trade whose business it is to deal with such matters, and there is every reason to believe that this, as well as many other defects, will be remedied at no very distant date.

The letter of "Veritas," whose personality is unknown to me, shows him to be a man of the right stamp—one after our own heart. He fights our battle bravely, and not only annihilates his antagonist with masterly skill, but consoles him in his defeat with a vivid portraiture of "the officer of the future." It is satisfactory to find that the result of his experience confirms my own, as to the very marked advance of late years in the qualifications and attainments of our brethren, and I trust that the continued progress of the next few years may produce even more gratifying results. He but very mildly describes the sensations that fill the breast of every reflective engineer, when he says he feels "dissatisfied" with our position. We have gone far beyond that. Dissatisfaction long ago gave place to murmurs of indignation, not loud, perhaps, but deep, and these in their turn have given way to fearlessly outspoken words and earnest and decided action, as evidenced by the formation of that Union of which I am proud to be called a member. It forms one of the amendments of the Mercantile Marine Act we intend to agitate for, and to cease not until we obtain, that Extra and First Class Engineers shall be allowed to pass in navigation; and this we consider imperative, in order to qualify us to take up that position on board ship which in the future we *must* be called upon to occupy. It will no doubt be a matter of regret to some of the more sentimental of lady passengers that the ever gallant spruce deck officer should have gone from their gaze to return no more, but a like regret was indulged in over the departure of the jolly, rubicund driver of the old stage coach, but nevertheless the world at large did not lose much by the change, nor will it by the equally inevitable abolition of deck ornaments. Our friend "Veritas," in his zeal, is perhaps just a trifle ahead of the times when he asserts ~~that the engineer is the~~ officer of the present, but we hope he is not much ahead, and we trust that the earnest efforts now being made will soon make his assertion an accomplished fact. I trust he may soon be enrolled a member of our Union, and that I may have the pleasure of becoming acquainted with him as a fellow worker in a good cause. Your remarks, Mr. Editor, as to the designation "Union" have not escaped the notice of "Excelsior," as he says he thinks it is rather a pity it was adopted. No doubt the natural association of ideas may lead one to connect the word with strikes of labour against capital, and so on, or with those large mansions which the long-suffering taxpayer has to provide for those who cannot or will not provide board and lodging for themselves, and that is certainly unpleasant; but, my dear "Excelsior," what are men to do when their choice is restricted nearly as much as that of Hobson? All the nice names—such as Association, Institution, Society, and so forth—had been already appropriated, and I am sure you would not have approved of our robbing any other organization of its duly recognized name, for you know what Shakespeare says in that fine moral sermon of his "Who steals my purse," &c. The choice was a difficult matter, but it had to be made, and so "Union" was fixed upon. It may not be euphonious, it may not be even considered genteel, but it has one good quality at least, and that is, it tells the truth. The movement it designates is intended to form a complete and practically independent society in each seaport, and to provide the means for these taking united action in any matter affecting their general interests, by having a General Council composed of their elected deputies, meeting periodically at a fixed centre, where a small permanent staff will be continually on watch, as it were, looking out for, and guarding against, squalls. This is practically having but *one* common desire, *one* defined mode of action, and may be defined correctly as a "Union."

Mr. Cope is much exercised over the admission of foreigners, and so would all our brethren be, if they knew as much of what is going on now as he does. I would like to say a deal about this, but as space forbids I only mention that this subject is already engaging the attention of the executive. His proposal that we should invite Lord Brassey, who is a certificated engineer, to help us, is a very good one viewed in a certain light. Lord Brassey is a most estimable gentleman, and his actions have proved him a worthy son of a worthy father, whose distinctions were gained in a more honourable field than those of rapine and wholesale carnage. Would that our peerage contained many more like him. He has been made aware of the formation and objects of our Union, and when he can see his way to do so, he will probably become a member, but until he intimates his intention of doing so, it would be unwise in the Committee to urge him to that course, as they would lay themselves open to a charge of flunkeyism unworthy of our profession, and for which no one would despise them more than Lord Brassey himself. The want of touch complained of is too true, but our endeavours must eventually obviate that, and no means therefore will be more efficacious than the establishment of those Club Houses in every seaport which you, Sir, hope will be, as it is our intention to make it, one of the principal features of the Union.

Permit me to say, in conclusion, that the membership is daily and steadily increasing, and that the week before last the writer was granted official permission to attend a private Board of Trade inquiry upon the conduct of an engineer, a permission not previously granted, I am told, to any society, was most courteously received by the chairman, and by his orders accom-

modated with a seat at the table during the inquiry. This speaks for itself, and shows whether the Union is likely to be listened to and treated with respect by those in authority.

Apologising for the unavoidable length of this letter, and again thanking you,

I remain, yours very truly,
THE HONORARY CHIEF SECRETARY,
Marine Engineers' Union.

91, Minories, London, 23rd May, 1887.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from April 19th to May 10th, 1887.

5669 J. L. Grandison. Light feed lubricators.
5676 J. Platt. The more perfect combustion of fuel for furnaces, &c.
5710 J. Johnson. Saving life at sea.
5749 J. Turns. Removing impurities from steam boiler feed water.
5766 R. H. C. & G. J. C. Ball. Operating ships' watertight doors.
5782 J. Edwards. Cleaning ships' bottoms.
5803 F. T. Warren. Attaching explosives to ships' sides.
5840 Newton (A. Nobel). Projectiles.
5841 G. Graveley. Seawater condenser.
5869 W. H. Harfield. Ships' windlasses.
5886 G. J. Hone. Tumbler slip hook for anchors, boats, &c.
5913 W. S. Cumming & D. Crawford. Taking the pitch and angles of screw propellers.
5964 A. H. Crockford. Water heaters and purifiers and boiler cleaners.
5975 R. Howarth. Collecting furnace ashes in a ship's bilge.
5989 O. E. Pohl. Ships' engines and propellers.
5998 B. W. Stevens. Line throwing gun.
6013 J. H. Street & Tangyes, Limited. Steam engine governor.
6097 A. L. Blackman. Dredgers.
6135 H. Field. Steam engine packing.
6138 J. J. P. Shervell. Life boats.
6143 H. J. F. Beckwith. Light feed lubricators.
6157 T. E. Hussey. Armour plating for vessels of war.
6180 J. F. Green. Propelling and steering vessels.
6184 F. S. Willoughby. Steering steamships.
6225 W. H. Harfield. Ships' riding bitts.
6278 G. H. Harrison. Steering vessels.
6280 Dobie (J. G. Dobie). Taking the trim of ships.
6290 W. H. Harfield. Ships' steam windlass.
6300 W. Bethell. Steam engine packing.
6315 .S Douglas. Propelling vessels.
6322 W. B. Thompson. Navigation of ships.
6343 A. Biver. Propulsion of craft.
6347 J. A. Birch. Anchors.
6368 A. Reaney. Projectiles for piercing armour plates.
6386 Leigh (J. F. Carpenter). Differential valve gear.
6415 R. Matthews. Trip valve gear for steam engines.
6436 R. Nixon. Safety cargo span grip.
6458 C. Henderson. Steering engines.
6522 W. Welford. Steering ships.
6574 E. N. Barnard. Generation of steam.
6584 R. B. Maddison. Electric marine governor.
6587 W. Thomas & J. E. Wilding. Starting gear.
6597 A. Low. Gun for throwing projectiles with line attached or not.
6611 W. Hamilton. Propeller.
6654 J. Holmes. Mooring breakwaters, vessels, &c.
6742 Grafton (W. R. Grafton). Screw propellers.
6743 B. Tydeman. Removing deposits from river beds, tidal basins, &c.
6745 H. P. Sherlock. Apparatus for checking instructions on board ships.
6755 H. A. Harvey. Coating for ships' bottoms.
6759 G. Rockliffe & W. Key. Ships' boats gear.
6760 J. H. Laidman. Stern post for vessels.
6773 J. Buchanan. Steam engine indicators.
6782 R. Coulter. Life saving collars and belts.
6792 A. Vogt. Dredging, &c.
6810 A. B. Brown. Loading and unloading ships.
6866 W. Allan. Working slide valves and stopping or reversing engines.
6883 P. G. B. Westmacott. Shipping, &c., coal.
6889 T. White & W. Carson. Damper apparatus for steam boilers.
6900 J. Willis. Armour plates, shot and shell.
6903 C. W. Pater. Life boats.
6922 T. Nordenfeldt. Gun mountings.
6932. J. Fielding. Mounting and working turret guns.
6959 M. P. Baxter. Bearing for shafts of screw propellers.
6968 J. Bramall. Propelling boats, &c.
6982 F. Edwards. Hatches for vessels.
6983 F. Edwards. Vessels.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

May 7th. Ramsey, Alexander W. Extra 1 C Glasgow.
„ 7th. Winterburn, W. G. .. Extra 1 C Glasgow.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

Dec. 10th, 1886.

Winterburn, F. C. 1C N. Shields

April 16th, 1887.

Bootchie, Donald 1C W. H'pool
Boyd, Walter G. 2C Hull
Burclay, John .. 2C Glasgow
Craig, Charles .. 2C Leith
Dixon, George .. 1C N. Shields
Dobson, John .. 2C Hull
Edwardes, John A. 1C „
Hay, Alexander 2C Liverpool
Heap, Hargreaves 1C Glasgow
Horne, Thos. H. 2C Dundee
Jessiman, Wm. 1C Leith
Lees, Saml. Jas. 2C „
Leslie, William 1C „
Marshall, Alex. 1C Dundee
Masson, John .. 1C Glasgow
Mitchell, James 2C „
Naismith, Thos. 1C „
Paterson, Wm... 2C Liverpool
Purvis, Thomas 2C „
Reid, Robert .. 1C Glasgow
Ritchie, Alex... 2C Leith
Selkirk, William 1C Glasgow
Stark, William .. 1C „
Sturrock, Peter K. 2C Leith
Sunney, Andrew 2C „
Watson, Jacob .. 2C „
Wood, James .. 2C Liverpool
Thompson, H. .. 1C N. Shields
Thornton, Jos. P. 2C „

April 23rd, 1887.

Barker, R....... 2C London
Bate, Wm. Jas... 2C Cardiff
Cameron, Hy. M. 2C Hull
Cogie, John .... 2C Glasgow
Conner, David .. 1C Cardiff
Dunn, Artemas .. 1C „
Haxton, Geo. B. 1C Dundee
Jenkins, Thos. .. 2C Cardiff
Jobbing, Ralph .. 1C N. Shields
Lindsay, Jas. F. 1C W. H'p'l
Menzies, T. E. .. 2C London
Murley, Thos. .. 1C Cardiff
Perkins, Wm. G. 1C „
Rutherford, Wm. 2C Liverpool
Sargeant, A. P... 1C Cardiff
Shearman, T. W. 2C London
Stowe, Geo. S. .. 2C Cardiff
Thomas, Wm. ... 2C „

April 30th, 1887.

Aird, George D. 2C Sunderl'd
Brecklesby, Rd. 2C Hull
Brown, John.... 1C Aberdeen
Bunton, John E. 2C Sunderl'd
Collard, Alfred S. 2C Liverpool
Coulson, Wm. T. 1C Sunderl'd
Crosby, John .. 2C „
Fitzgerald, Jas. 1C N. Shields
Fletcher, Hugh 2C Liverpool
Fraser, William 2C Sunderl'd
Graham, Hugh .. 1C London
Grieve, Jas. A... 1C „
Hinley, Wltr. F. 2C „
Kennaugh, W. B. 1C „
Laing, Robert ... 1C „
Loughlan, Edwd. 1C Sunderl'd
Macdonald, Paul 2C Liverpool
Main, John .... 1C Aberdeen
Mason, H. D. .. 2C Liverpool
McPherson, Alex. 2C London
Mitchell, James .. 2C Liverpool
Nicholson, George 2C Hull
Quenet, F. A. .. 2C Sunderl'd
Scrafton, John J. 2C N. Shields
Skinner, Hy..... 1C London
St. Clair, Alfred 2C Bristol
Urie, Hugh G. .. 2C Liverpool
Waters, Arthur G. 1C London
Wilson, Peter .. 2C Sunderl'd
Wiseman, Henry 2C „

May 7th, 1887.

Armstrong, Jas. 1C London
Boyd, Thos. .... 1C N. Shields
Boyle, James.... 2C Liverpool
Brodie, Thomas.. 1C Glasgow
Buckwell, Geo. W. 1C London
Cockburn, David 2C Glasgow
Elliott, John E.. 2C N. Shields
Falkenberg, C... 2C „
Grierson, James 2C Liverpool
Hammonds, J. F. 1C „
Iliff, Alfred .... 1C London
Law, Geo. H. .. 2C Greenock
Lawrence, Joseph 1C Glasgow
Lister, Arthur .. 2C Liverpool
Mackenzie, K... 1C Glasgow
Manning, G. R. 2C London
McDonald, D. W. 1C Glasgow
McDonald, Ferg. 1C „
Richardson, Thos. 2C N. Shields
Taylor, Alex. G. 2C Greenock
Thomas, Thos. E. 1C N. Shields
Warlow, Thos. F. 2C Liverpool
Wimshurst, H. J. 2C London

The Marine Engineer.

LONDON, JULY 1, 1887.

EDITORIAL NOTES.

HAVING been much interested in the very scanty details which reached us of Mr. James Hargreaves' new heat engine, we are glad to have some more exact figures before us by which to estimate the possibility of this form of motor. It is well known that the efficiency of any heat engine, whatever may be the medium employed for the production of the work, is measured essentially by the difference between the initial and final temperatures, and it is also well known that the best working results that have ever been attained by ordinary steam engines do not exceed one-tenth of the theoretical value of the fuel employed to develop the power. It is obvious that in the ordinary steam engine the efficiency of the engine *per se* cannot be very great, since the initial temperature of the steam is not usually very high, and therefore the difference between initial temperature and final temperature in the condenser cannot show a large possible maximum efficiency. As for instance in Watt's time, the ordinary temperature of boiler and condenser might be taken only as 230 degrees F. and 110 degrees F. respectively, which gives a comparatively insignificant difference, representing fall of temperature. The more modern high-pressure engine will work at, of course, considerably higher temperature than in this first example, as for instance, from 350 degrees F. to 450 degrees F., which, with the condenser temperature as before at 110 degrees F., shows a much larger available margin for efficiency. It must, however, be remembered that this would measure the efficiency of the engine alone, and that when the comparison is required with regard to the heat developed by the fuel, a heavy allowance must be made for the loss of efficiency in the boiler, that is, of from 50 per cent. to 60 per cent. Gas engines and hot air engines, therefore, have the very considerable advantage over steam engines, that the prime source of heat, namely, the fuel or combustible gas, is utilized directly for the production of power, and is therefore available in the engine at the highest possible temperature, avoiding the loss consequent upon the use of a boiler altogether. The possible efficiency, therefore, of a gas engine or hot air engine may be represented at a much higher figure than can be applicable to the steam engine, but as a drawback, high temperature, as used directly in the cylinder, carry their own danger of deterioration to the material of the cylinder, and it is difficult in such engines to abstract a very large proportion of such available heat, the temperature of the exhaust of a gas engine being usually very high. Though we are still without specific details as to the manner in which Mr. Hargreaves carries out his invention, he seems to be working on thoroughly reliable scientific grounds, and to have accomplished a result which is so far novel that it is difficult to realize how it has been effected. We have it on good authority that the temperature of the working cylinder must be nearly 2,000 degrees F., and that the temperature of the exhaust is not more than 220 degrees F., which includes steam and all the products of combustion. We must imagine that this enormous reduction in temperature can only be effected by the direct evaporation of water into steam in the heated cylinder, as where the hot air is used elastically for the development of power, it is difficult to believe that without evaporation the temperature could be so greatly reduced. Such figures theoretically would give a possible efficiency to such a thermomotor at least four times better than the best combined steam engine and boiler. Mr. Hargreaves, however, does not seem to have anything like realized such a great increase of efficiency, but to have arrived only at an efficiency about equal to that of the gas engine. As, however, he uses a fuel, namely, gas tar, which for the same efficiency will only cost pence where gas would cost shillings, he has, even up to the present stage, effected a surprising result. For general application, however, to large motors, we see one defect which is common to most gas and hot air motors, namely, that he does not obtain the same work per area of piston as can be obtained from the steam engine, namely, one N.H.P. per every ten square inches of piston area. Mr. Hargreaves, however, asserts that in the new engine being built for him he will be able to approach much more closely to the theoretical possibilities of his system as regards efficiency, and possibly as regards power per area of piston, and as he has obviously a handsome margin to work on, we think it quite possible that his anticipations may be to a great extent realized. We are extremely anxious to have exact details of Mr. Hargreaves' mechanical arrangements, as we are only hitherto criticising in the dark.

AFTER having so frequently criticised the present methods of construction of liners and other large vessels with regard to the practical inefficiency of their supposed division into watertight compartments resulting so frequently in fatal disaster after collision, we are glad to be able to note the gratifying results to the contrary

consequent on the collision of the *Celtic* and *Britannic*. The details of the actual accident are no doubt already well known to our readers. The *Britannic* going east, sailing from New York for Liverpool, was proceeding at her usual speed of about sixteen miles an hour through a heavy fog with a smooth sea on her first day out. The *Celtic*, on the other hand, which was considerably south of her regular course for New York, was proceeding but slowly and blowing her fog whistle. Although the respective fog whistles seem to have been heard from the vessels they apparently had formed no exact idea either of their respective directions or distances. This is a well known peculiarity and danger as regards the location of sound in a fog, and it is strange that no effective means have been hitherto applied to properly locate the position of a noise in a fog. We have seen a device, the invention of a Mr. B. Stewart Wallace, which is practically an ear trumpet especially constructed to locate the exact direction from which a sound comes. This it seems to us ought to be a necessary adjunct to every ship for use in fogs, for if the rules of indicating by the number of whistles the course upon which the ship is travelling be properly observed, and the power of exact location by such an ear trumpet is also added, there ought to be no difficulty for vessels to avoid collisions under such circumstances. In this case, however, it is said the vessels had no idea of their immediate proximity until they were only about four lengths apart. As the *Celtic* suddenly loomed up on the port side of the *Britannic* her commander reversed her engines, whilst the *Britannic* went ahead at full speed in an attempt to cross the bow of the *Celtic*. It was however too late, and the bow of the *Celtic* struck the *Britannic* about 10 ft. abaft of the engine room. The thick inch plates of the *Britannic* were indented by the blow below the water line, making a jagged hole, while the bow of the *Celtic* was broken away about 8 ft. from the top, and the lower part twisted until it pointed towards the stern. The result was that one compartment of the *Britannic* and the forward compartment of the *Celtic* at once filled with water, and we are glad to report that the watertight bulkheads in both vessels were sufficiently efficient to prevent further serious disaster than a slight setting of the vessels at the head and stern respectively. The collision of two such enormously heavy vessels without more serious disaster or loss of life, which might have extended to 2,000 persons, is immeasurably reassuring to Atlantic travellers and creditable to the design and construction of these magnificent vessels.

Torpedo boats have been brought down to such a condition of refinement to meet the special circumstances of their work, that it appears probable that they have become too delicate for rough or unskilled handling. Our reason for these remarks is the very indifferent, one might almost say disastrous, performance of a fleet of torpedo boats some little time back, which were required to race a distance of 100 miles at speed as a test. Out of twenty-two, seven failed to run the course at all, having been obliged to drop out of the race from one cause or another which amounted to practical disablement. These causes we may sum up as being the collapse of the furnaces in two instances, one resulting in the loss of life and the running excessively hot or partial breakdown of their machinery, by one cause or another. We are glad to see that all Messrs. Yarrow and Co.'s boats, as well as those by White, of Cowes, which were running in the test, have maintained their high credit for efficiency, and arrived successfully at the required goal, the first three being No. 1, by Yarrow; No. 35, by White; and No. 46, by Thornycroft, respectively. Such a heavy percentage of failures under a trial test to which the boats might at any time be required to be subjected serves to our mind emphatically to point out that an efficient fighting seaman of the present day should be an engineer. By our readers it will be readily recognised that the collapse of furnace flues, the running excessively hot of bearings, and the springing or bending of parts by loss of a nut or other detail, the blowing of joints, &c., are all accidents, the due avoidance of which depends upon the care and attention bestowed to the machinery by those in charge. As an analagous case what would we anticipate would be the result if all the splendid and reliable Atlantic and P. O. Liners were at short notice placed under the control of strange and untrained crews, many of them seamen rather than engineers, and were all to run a 100 mile race against one another. We on our part should anticipate equally disastrous failures as those which overtook the torpedo boats. It appears that the crews for these torpedo boats were in the larger proportion of cases nearly all scratch crews unaquainted with the idiosyncracies of the boats and engines, and for the most part without any reliable experience. Until the absolute necessity of skilled and trained engineers, both as officers and men, is more fully recognised by the Admiralty, for the successful working of the present complicated machines afloat, we have little doubt that such disastrous experiences as those referred to will constantly recur. That such tests will serve to show faults in design, which may tend to render the

engines more liable to breakdown we fully believe, and they are, therefore, of great importance, but we are anxious that the lesson should not be lost equally upon the Admiralty as to the necessity for possible improvement and care in the staffs into whose hands such delicate machines are entrusted.

We may note with interest the first application to our knowledge of triple-expansion engines to a war vessel. This has been applied by Messrs. Sir W. Armstrong and Co., of Elswick, to a vessel for the Italian Government, now called the *Dogali*. She is not a very large vessel, being only 2,050 tons displacement, and is designed as a fast cruiser. The triple-expansion engines have been fitted by Messrs. R. & W. Hawthorn, Leslie and Co., of Newcastle-on-Tyne, and are of the twin screw horizontal type. Each set of engines has three cylinders, 30 in., 45 in., and 73 in. diameter, with a stroke of 2 ft. 9 in. These engines have a very high range of expansion, and at 155 revolutions developed up to 7,600 H.P., realising a speed of 19·6 knots per hour. This is a very handsome performance, and will place this cruiser among the most serviceable in foreign navies. It is very noteworthy that most of the foreign ironclads which have developed noteworthy qualities of speed or fighting power are the production of our private builders, who seem to our mind to considerably outstrip the best efforts of our Government yards. These results all point to a view which is essentially English, namely, that independent enterprise always works better than a monopoly, even if it be a Government monopoly, and we have little doubt that the Government will best consider the interests of the nation at large by following their present praiseworthy efforts to deal as largely as possible with our private builders. It would be a curious irony in years to come to find our Government-built ironclads worsted in a naval battle by the results of the skill and ingenuity of our private and energetic shipbuilders and engineers. To all appearance, as matters go at present, this may occur, as the best and most formidable of many foreign ironclads are the productions of English shipyards. We do not for a moment suggest that such freedom of trade should be interfered with, but we certainly do suggest that all available efforts and ingenuity of which our private builders are capable should be as largely as possible monopolized by the English Government.

In spite of the frequency and comparative staleness of industrial exhibitions, that at Newcastle seems to be an exceptionally good one. As usual, the exhibits are comprised in a series of classes covering almost every known form of industry. In compliment to the character of the district in which the exhibition is held, coal mining and its products, metalliferous mining and machinery hold the first and most honourable position among the various divisions, though both the building industries, chemical industries, fisheries, agriculture, hygiene, food, and science and art are all amply represented. The variety of these classes and material no doubt largely enhance the interest to the general visitor, as is evidenced by the very large number that have already visited the exhibition, the total being already 500,000. As far as our special department of marine engineering is concerned, a special division is allotted, comprising the two classes of marine engines and boilers, and shipbuilding. All the northern manufacturers seem to be handsomely represented, both in models of engines and boilers, with details of the same, as well as a large number of models of sailing vessels, launches, and ironclads. The excellence and variety of the various models of vessels may be readily realised when we state that Messrs. Armstrong, Mitchell & Co., Limited, show no less than 59 models of all the best samples of steamers, gunboats, cable ships, cruisers, and petroleum steamers that have latterly been built by them from the most improved designs. All the other north-country builders are equally well represented, such as Messrs. Thompson and Sons, of Sunderland; Messrs. Milburn, of Newcastle; Messrs. Schlesinger, Davis & Co., of Wallsend; Messrs. Dixon, of Middlesboro', with dozens of others too numerous to mention. As usual, "Lloyd's Register of British and Foreign Shipping" have given most valuable help to the model department by the enormous exhibit of some two to three hundred models of vessels and fittings, which appear to have been carefully selected to illustrate the development in size and form of ships from A.D. 1764 to the present date. The old-fashioned models of the beginning of this century are naturally most curious and interesting, including, as they do, the *Scotia* and *Great Britain* of historic fame, with many samples of splendid East Indiamen built in the course of the last century. Every facility of access to the exhibition for visitors from the south and other districts are given by the various railways, whose attention to the necessities of frequency and punctuality in their services cannot be too highly commended. The combined services of the Midland and North-Eastern Railway are particularly noteworthy for these excellencies, the journey being such as may be effected from London with comfort and wonderful despatch.

SUBMARINE WAR-BOATS.

Among the more prominent naval subjects which have come to the front for discussion during the last few months is that relating to the use of submarine boats in warfare. Recent new designs and improvements in these craft, and the great additional attention which is given to them by naval constructors and naval officers, justifies their present significance for consideration, discussion, and extensive experiments.

As indifferent historical accounts have been given in the newspapers and periodicals concerning the progress of submarine boat construction from its commencement, we will firstly furnish such parts of this information as we believe nautical men require, and then make a few other relevant observations on the subject.

The first authentic account of the invention of a submarine boat is that relating to a craft of this kind made by Debbrel, in the reign of James I. It was tested on the Thames, appears to have been propelled by oars, and to have carried twelve rowers in addition to passengers. The foul air was purified by a liquid called the "quintessence of air." The inventor died before the boat was completed. In 1774 a person named Day designed a new kind of boat which went down with him in its trial in Plymouth Sound, and was not recovered for a considerable time afterwards.

The first boat in which submarine sailing and torpedo warfare combined was experimented with was constructed by Captain Bushnell, of the United States of America. Although the craft was a covered in and very strong wooden boat, its dimensions were so small that it only contained enough air for one man's requirements for half-an-hour. The boat was driven by an oar worked in a watertight joint, and had a rudder and compass. When required to go beneath the surface, water was admitted into the craft by a valve; and to cause it to ascend, water had to be pumped out of it by hand, while as an additional means for bringing it to the surface external weights could be taken off. The object of this boat was to attach a torpedo to the bottom of a ship, which, after a certain interval, and after the submarine boat had time to remove out of danger, would explode, or would be fired by an electric wire. Although the inventor of this craft proved that a charge of gunpowder could be fired under water by means of such a boat its operations seem to have been unsuccessful.

Robert Fulton, who introduced steam navigation, revived the submarine warfare question after it had been neglected for about twenty years. When residing in France, in 1797, he made various experiments on the Seine in that year, and though they failed, he believed in the use of his boat as a destructive hostile agent. He could not persuade the French or Danish Governments to pecuniarily assist him in his designs. In 1800, however, Napoleon I. advanced the funds for this purpose, and during the subsequent year Fulton made further experiments under the patronage of the first consul in the harbour of Brest. These trials were mainly carried out by a submarine boat designed by him, called the *Nautilus*. In some of his tests with this craft he submerged her to a depth of 25 ft., and remained under water at first for an hour and afterwards for several hours at a time, with three other persons. Highly compressed air was provided for respiration.

When on the surface, the boat had two sails, and appeared like an ordinary sail boat. When it had to dive, the masts and sails were struck. A machine was added to this craft by the inventor whereby he blew up a large boat in the harbour of Brest. During submersion he was successful in propelling and steering his boat, and in destroying some vessels by exploding gunpowder beneath them. As he could not prevail upon the French Government to adopt his invention, Fulton proceeded to England in 1784. Mr. Pitt here manifested considerable interest in his new boat, and some expensive trials were carried out with it, but which were productive of no results. After this the inventor returned to the United States, the Government of which spent a considerable sum with a view of improving his submarine boat, but to no purpose.

In 1821, Johnson, an Englishman, introduced another kind of boat for submarine warfare, and in 1851, a Bavarian named Bauer invented one—both were failures. About the latter date the trials of the submarine boat of the Frenchman Alexandré, in New York Harbour, appeared to share the same ill fate.

In 1845, a shoemaker named Phillips, of Laporte, Indiana, designed a submarine boat which was modelled after the *Whitefish*. In this craft he sunk to a depth of 20 ft., and when it collapsed an escape was made by a manhole. Another boat of a cylindrical cross-section and cigar-shaped was constructed by this inventor In such second craft automatic apparatus was provided for governing the depth of submersion. In a third boat built by him he perfected the means for automatically balancing the boat, and appliances for handling from the interior various tools working on the outside. Upon endeavouring, however, to reach a wreck in a depth of water of 155 ft., his boat leaked very much when it had reached 100 ft. deep, and therefore returned at once to the surface. In a subsequent trial he lost his boat where he lowered it attached to a hawser to the bottom. When endeavouring to lift it the hawser broke and the boat remained, but at the time no person was in it. No practical results took place from these boats, although different negotiations with national Governments were entered into for this object.

A Mr. Delaney, of Chicago, in 1859, brought a submarine boat to England. The craft was egg-shaped in transverse section and tapered to a point at either end. She was provided with two metallic tanks, one of which was filled with atmosphere forced therein by an air-pump. A pipe with a stop-cock connected this receptacle with the second tank, which contained water. By pumping water into or out of the second tank the engineer could, through the action of the air in the first, raise or lower the boat to the various levels required.

During the Crimean War the Russians used a kind of submarine mine which could be moved a short distance. It was not a boat, but was of the character of a locomotive diving bell. At this period the British Government spent about £7,000 in purchasing and testing a similar vessel designed by Mr. Scott Russell. The model of a German invention with some novel apparatus was tested before the Prince Consort at Osborne, but sank and was never recovered.

It was not before the American Civil War that submarine boats were used as engines of war. At that time the Federal man-of-war, *Housatonic*, was sunk by one of these craft carrying a spar torpedo. This boat, which was cigar-shaped, was nearly submerged when at the surface, and could be raised and lowered to any necessary depth by admitting or pumping out water. She was constructed of boiler iron 35 ft. long, and carried a crew of nine men, for whom air was provided for four hours. She was driven by a screw propeller worked by eight of the crew, and her maximum speed was four knots an hour in smooth water. For raising and falling the boat when in motion two fins were fixed on its exterior. Two man holes were fitted, which were provided with bull's-eyes for directing the course of the boat. This craft was intended to pass under the bottom of a vessel, towing a torpedo after her, designed to explode on impact. Before making her last attack she caused the loss of fourteen men by drowning, when nine additional lives were added to this list. When she successfully attacked the *Housatonic* she was armed with the bow spar torpedo, and went down because she ran into the aperture formed by the explosion of her torpedo.

An iron submarine boat, 35 ft. long and 6 ft. in diameter, was built by the United States Government in 1862. The boat was fitted with apparatus for producing oxygen and a receptacle containing lime, through which the atmosphere was to be forced to purify it. It was arranged that a diver in submarine armour was to leave the boat and attach to the enemy's ship a torpedo, designed to be exploded by clockwork. The boat was invented by a Frenchman, but after receiving a reward for the boat he decamped, and nothing was afterwards accomplished with the craft.

In the following year a boat was constructed at Mobile by Austilt. It was arranged to be propelled by ordinary steam-engines when on the surface and electrical engines when below. No definite results of its trials have been notified.

In 1867, a French submarine boat, called the *Plongeur*, designed by Admiral Bourgois and Mr. Brune, was shown at the Paris Exhibition of 1867. She was 26 ft. long and 9 ft. deep, and fitted with middle bilge keels. Two tanks containing compressed air were carried by her, while four large tanks were placed at the bottom of the boat to sink her. The latter-mentioned tanks were connected with the water outside and the air tanks. She was likewise fitted with a compass for steering by, a water gauge to indicate the depth of sinking, and an air gauge to show the atmospheric pressure in the boat. At the bottom of the boat there were rectangular valves for entrance or exit from such to be used by divers and to affix torpedoes to a ship's bottom. A round opening for entrance and exit was made on the top of the craft, and a metallic cupola fitted with bull's-eyes for observation. Apparatus was also fitted to the boat for spraying water through the air, in the inside of the craft, on its becomming foul, while escape valves for discharging any vitiated air were likewise provided. Pumps

were used to fill the water tanks, and these receptacles were emptied by compressed air. The boat was driven by a three bladed screw, manipulated by four of the crew, and her speed was about four knots an hour. The French Government made secret experiments with this boat. It is said that about fifty boats, constructed on an improvement of the one just described, are now in the possession of that Government.

The Russian Government has for years expended much money upon the improvement and trials of submarine boats. In 1868 a craft built of the "Alexandrofsky" type was tried on the Neva. Another boat constructed on the "Bjevalsky" system was tested about five years ago at St. Petersburg. She was 20 ft. long and was driven by a screw turned by five men. She descended and ascended by increasing and lessening her water ballast. She is stated to be held in a horizontal position by moving the water ballast longitudinally. Chemical means were adopted to supply her with air so as to keep her crew under water up to nine hours. She has frequently descended to a depth of 15 ft. Her speed was three knots an hour. Many of these kind of boats, it is stated, have been built for Russia. It is also reputed that the Russians have purchased about 300 submarine boats constructed on the Goubet type, which is called the *bateau-poisson*. This class of boat carries two persons, and is supplied with air for four hours, purified by chemicals. The boat is propelled by electricity or treadles, working paddles, and its speed is about five knots. The object of the boat is to get beneath an enemy's man-of-war and release a torpedo, carried outside, which by its floatability ascends and attaches itself by spikes to the bottom of the vessel. Upon this being accomplished the craft withdraws to a safe distance and explodes the torpedo by electricity.

About ten years ago, Mr. Garrett, a clergyman, invented a submarine boat which was made at Liverpool. It was 45 ft. in length, and of the shape of two cones, and descended by pistons which altered the displacement of the boat by being drawn in and pushed out, and also by central rudders, which steered it up and down; compressed air, purified by chemicals, was supplied to the crew. The boat does not appear to have been successful, and was lost on the Welsh Coast. Since this event other boats have been patented but not built.

At about the same date, viz., 1877, Mr. John P. Holland built a boat which was to be driven by a petroleum engine. This craft is reputed to contain many features which seem to have been afterwards used in the Nordenfeldt submarine boat, including reserve buoyancy and the continual maintenance of a horizontal position. This last purpose was not deemed advantageous, as it necessitated too much delay in going under water or making a change of level. The reserved buoyancy property was apparently possessed by Bushnell and Fulton's systems of submarine navigation. The engines of Holland's boat were inefficient, while in other cases it was far from perfect for the object for which it was designed.

In 1881, a larger boat, of 31 ft. in length and 6 ft. in diameter, was launched, and performed more, it is said, than any of her predecessors. It is evident that it was entirely under control both in its surface and submarine trials. It was driven by a petroleum engine and carried air compressed to about 15 atmospheres. Consequently it could remain below the surface of the water while removing a long distance. Several new means were provided for its operation, and it possessed a number of positive means of aggression which surpassed any submarine boat previously built. Holland lost the control of the boat on account of disagreements with the parties who, in addition to himself, were interested in it, and nothing more was apparently done with the craft. A third and smaller boat, designed by the same inventor, and to be worked by one man, was accidentally sunk.

Another submarine boat by Holland was built at Fort Lafayette. It was cigar-shaped, 50 ft. long, of circular cross section, with a diameter of 8 ft. It was fitted with reservoirs sufficient to hold air at 70 atmospheric pressure, so as to enable the boat to be propelled under water for two hours, and when the boat was stationary the crew could live in it for several days when submerged. The craft was provided with different means of aggression. One of these was a pneumatic gun for shooting large charges of dynamite or other of the higher explosives. It was easy to obtain a range of between 600 and 800 yards for a shell containing from 200 lbs. to 500 lbs. of explosive. The boat could come within a mile of a hostile ship with only the small conning tower of the former awash. It could then be submerged, and its occupants still see what was going on at the surface by means of a camera tube which could be heightened several feet, but which was so small a piece of mechanism as to be practically unobserved by an enemy. When the craft reached within striking distance, the bow, through which the muzzle of the gun projected, could be raised above the surface and a shell shot through the air. The boat was then to instantly dive below, both by the recoil process and the action of the engines, and take up another position for renewing its offensive operations if desirable. The boat was then to be considered as a floating gun carriage, and to be provided with apparatus which, on a favourable opportunity, it might pass beneath a hostile war-ship, and, automatically, attach to the bottom of that vessel a torpedo which could be exploded after the boat had returned to a safe distance. It was also arranged that this boat could anchor a buoyant torpedo or cast a ground mine underneath an enemy's ship and explode it.

In 1881, a submarine boat was built by Trajan Theodoresco, a young Roumanian engineer, which was said at that time to eclipse all its predecessors in appreciable efficiency. Up to certain dimensions it is reported that the boat could be subnavigated at a depth of 100 ft. for 12 hours at a time. The inventor, however, stated that she could descend to a depth of 300 ft. Her submersion and rise to the surface was gradually or at once effected by vertical screws. The receptacle for air for the crew was sufficient to supply them from 12 to 14 hours, but if necessary the reservoir could be refilled with fresh air for another 12 hours by submerged pipes telescoping into each other and extending to the surface for this object. Sufficient light was supplied in the boat to enable all its occupants when submerged to see all obstacles at any depth to 130 ft. No additional news appears to have been notified respecting this boat.

In 1882, a new submarine boat was invented by M. Djevetsky. It was 20 ft. long, cigar-shaped, and weighed about two tons when fully equipped. Four men propelled her screw by the feet. Sliding weights on horizontal quick rails were used to lower the boat to a depth of 50 ft. and to raise her to the surface. Her normal position was slightly submerged when fully loaded and equipped. The glass dome by which she was steered was a little above the surface of the water. When required to go to a particular depth the weights were shifted forward, and the propeller being worked, the boat would instantly dive under. When it reached the required depth the weights were moved to the centre and the boat was then placed in a horizontal position. When it was desired to raise the boat the weights were moved back to the stern. The craft had two torpedoes attached to her by levers. When the boat passed beneath a hostile ship the torpedoes could easily be detached from the boat, and would, on their rising, attach themselves to the hull of the enemy's ship by gutta-percha appliances. The boat would then return to a safe distance, and would, by a wire paid out in the retreat, explode the torpedoes. A large quantity of fresh air, which would be sufficient for the requirements of the crew for twenty-four hours, was supplied. The vitiated air from respiration was absorbed by chemicals.

(To be concluded in cur next.)

ON THE CORROSION AND PROTECTION OF IRON AND STEEL SHIPS.*

By VIVIAN B. LEWES, Esq.

In 1822 the first sea-going vessel built of iron was launched in the Thames, and with this important era in the history of shipbuilding, the shipowners of the country incurred a fresh responsibility; as the use of the new material, while bringing with it innumerable advantages, also gave rise to the necessity for protecting the bottoms of the ships, not only from fouling, but from corrosion and rapid decay.

Under these circumstances there slowly crept into the market a class of paints and compositions called protectives, some of which experience has shown to be fairly good, but in very few cases does any deliberate attempt seem to have been made to arrive at the cause, or causes, of corrosion, and to stop it by scientific means; and now, little more than fifty years after the general adoption of iron as a material for shipbuilding, it is, in turn, being replaced by steel, and with increased knowledge as to the strength of material, so is the substance of the plates being reduced, rendering their protection from the wasting process of corrosion absolutely imperative.

During these years science has not been idle, but the work done and the facts established are so scattered through the scientific

* *Read at the Twenty-eighth Session of the Institution of Naval Architects.*

[illegible] of Europe, that few shipowners know much beyond the fact that rust is an oxide of iron which, in forming, eats away their plates, and my object in this paper is to bring before the Institution of Naval Architects certain facts and suggestions which, I hope, may tend towards clearing up a subject of paramount importance to the first maritime Power of the world.

The first point that strikes one on approaching the subject of corrosion is the great divergence of opinion existing as to the relative rates of corrosion of iron and steel, which has arisen from the fact that many of the experimentalists and writers on the subject have based their theories upon results in which metal, very different from any in actual use, has been placed under conditions which could not possibly befal the bottom of a ship.

In reviewing the work done on this part of the subject, it would be useless to go back more than twenty years, as before that the iron and steel used were very different from those we have to-day, and in the same way the colossal researches of the Boiler Committee of 1874-78 throw but little light on the relative value of iron and steel as regards resistance to corrosion as it would affect a ship's bottom, their experiments being made under totally different conditions.

Much more to the point was a series of experiments tried in 1877-78 on the hull of the *Camel* at Portsmouth, in which naked plates of iron and steel were exposed under the same conditions and for the same period, with the result that there was hardly any appreciable difference between them.

In 1877 also, Sergius Kern, M.E., St. Petersburg, made some experiments on iron and steel plates, which are of especial value from the fact that the metals used were carefully analyzed, with the following results:—

I.—Steel Plates.

	I.	II.	III.	IV.
	Per cent.	Per cent.	Per cent.	Per cent.
Carbon	0·290	0·300	0·180	0·234
Manganese	0·380	0·412	0·275	0·178
Sulphur	0·010	0·010	0·012	Traces.
Phosphorus	0·005	0·008	0·010	0·032
Silicon	0·015	0·011	0·010	0·021

II.—Iron Plates (Average Analysis).

	Per cent.
Carbon	0·110
Manganese	0·187
Sulphur	0·010
Phosphorus	0·004
Silicon	0·008
Copper	Traces.

These plates were immersed in sea water for thirty days, and the loss of weight carefully determined.

III.—Action of 100 Litres of Sea Water (Sp. Grav. 1·027) on One Square Metre of Iron and Steel $\frac{1}{8}$ in. in Thickness.

Iron.	Loss in Grms.	Steel.	Loss in Grms.
I.	25·78	I.	22·75
II.	25·54	II.	22·34
III.	26·04	III.	21·83
IV.	27·44	IV.	21·96

In other words, that for equal surfaces exposed, the iron had lost by corrosion 26 grams, whilst the steel had only lost 22.

In 1881 Mr. Parker, of Lloyd's, read a paper on "The Relative Corrosion of Iron and Steel," at the Iron and Steel Institute, which is, perhaps, the most important contribution yet made to the subject, and his conclusions can be best summed up in his own words: "That so far as experience had gone, mild steel did not corrode, to any serious extent, more rapidly than iron under similar conditions;" and I think, from the evidence adduced, there is no doubt that in the slow processes of corrosion affecting a ship's bottom, steel is but little inferior to iron, although, in the former case, pitting and local action are more defined, whilst in the case of the iron the corrosion takes place more evenly over its whole surface.

The ordinary theory of rusting of iron in air or water is, that it is due to a great extent to the action of carbonic acid, free in the air and dissolved in water, and not to the action of moisture, or water and oxygen only; and this has been clearly proved by the fact that pure air, or water containing an alkali which will absorb all carbonic acid, has little or no action on iron or steel.

The iron is attacked by the moist carbonic acid forming carbonate of iron, and this is converted by oxygen into ferric oxide (rust), and the carbonic acid is again liberated in contact with the iron, taking up more metal; again the conversion into rust ensues, and the carbonic acid continues its career as middleman, dissolving up the metal and handing it over to the oxygen, until the whole of the iron is converted into a porous mass of rust.

This action takes place in air, and also most probably on abraided portions of a ship's side, close to and above the water line, where the plates, either by the chafing of chain cables and boats, or the trying influences of wind and water combined, have been denuded of their protective coatings; but anyone who has examined a vessel when in dry dock before her bottom has been touched, will have noticed a second kind of corrosion, commencing first as little nodules, not much larger than a pea, under the protective and antifouling compositions, gradually forming a small water blister, which increases in size, and from being first filled with rusty water, gradually becomes filled with spongy rust, and finally blossoms out into a full-blown rust cone, often an inch and over in height, and covering pitting a sixteenth of an inch deep. These heavy rust cones are not generally evenly distributed over the whole immersed surface of the ship, but as a rule are most abundant on the rudder, near the stern, and below the bilge, whilst if they had been formed from carbonic acid, oxygen, and moisture in the same way as ordinary rust, one would have expected to find them evenly distributed from the water line to the keel, as both Mr. Buchanan and Tornöe, from their exhaustive experiments on the *Challenger* and Norwegian expeditions, agree that the amounts of carbonic acid and oxygen dissolved in sea water do not appreciably vary within the depth represented by the draught of a vessel.

Iron forms three well defined compounds with oxygen:—

I. Black magnetic oxide or mill scale.
II. Ferric oxide or rust.
III. Ferrous oxide.

In the mill scale the iron and oxygen exist in the proportion of 168 parts by weight of the metal to 64 of oxygen; in ferric oxide, which forms the basis of rust, 112 of iron to 48 of oxygen; and in ferrous oxide, 56 of iron to 16 oxygen.

This last oxide has an intense affinity for oxygen, and will greedily take it from the air, being converted into ferric oxide; but beyond this, ordinary processes of oxidation do not go, as the black magnetic oxide is only formed at an increased temperature, and, as might be expected from these facts, the rust formed in air, or where iron is freely exposed to the action of carbonic acid and oxygen dissolved in water, consists almost entirely of the ferric oxide combined with a certain amount of water.

In the same way, rust formed upon exposed portions of ships' plates under water also has this composition; but when we come to examine the heavy rust cones, we generally find present a certain amount of the ferrous oxide, which suggests that the cones have been rapidly formed by some action which has not allowed time for the complete oxidation of the metal into ferric oxide.

It has been observed that when warm sea water acts upon metallic iron, a rust rich in this ferrous oxide is formed, and in 1882 the late Richard Cowper, on analysing a piece of the corroded surface condenser of H.M.S. *Spartan*, which had been in constant contact with sea water at a temperature of about 100° F., found that the corroded portion consisted of

Ferrous oxide = 42·33 per cent.
Ferric oxide = 2·21 ,,

and this great preponderance of ferrous oxide over ferric has

been also noticed by Professor Liversidge in a piece of oxidised iron from the blade of a screw propeller which had been corroded in sea water at the ordinary temperature. (Proc. Roy. Soc. N.S. Wales.)

The unequal distribution of the rust cones suggested local galvanic action as a probable cause of their formation, but although in many cases the metallic constituents of the anti-fouling composition used rendered this probable, no metallic impurities could be found at the base of the cone or on the pitted portion of the plate to account for it, and under these circumstances it seemed probable that the galvanic action must have been set up by the rust itself, or, if set up by some speck of foreign metal, at any rate carried on by the rust.

It is a well-recognised fact, that the higher magnetic oxide of iron increases the corrosion of iron and steel by galvanic action, and it seems, therefore, probable that the ferric oxide would do the same; and in order to see if the other oxides behaved towards the metal in the same way as the magnetic oxide, under the exciting influence of sea water, the following experiments were tried:—

Some steel plates, 4 in. by 1 in., were cut from the same sheet and were faced on one side; on the polished surface of one a piece of thin blotting paper was laid, so as to entirely cover it and project ⅛ in. beyond its edges; this was wetted with sea water, and the other plate, with its polished face downwards, was placed on the wet paper, so that the two polished steel faces were separated by the blotting paper soaked with sea water. Wires were then placed in contact with the dry backs of the plates, and fixed in position by a dry wooden clamp. On connecting this couple with a "Sir W. Thomson's Marine Reflecting Galvanometer," a deflection of 20° on the scale was obtained. The upper plate was then raised, and its face having been smeared over with a thin paste of magnetic oxide, mixed with sea water, was replaced in position, giving a deflection of 112° on the scale. The plates were then carefully cleaned and dried, fresh blotting paper, moisened with sea water, placed in position, and the upper plate smeared with hydrated ferric oxide and sea water placed upon it; this gave a deflection of 65°. Whilst hydrated ferrous oxide (made by precipitation and washing with well-boiled sea water in an atmosphere of coal gas) only gave a reflection of 25°, or very little more than the plates by themselves, portions of a rust cone treated in the same way gave a deflection of 110°.

In each case the reading was taken immediately the needle came to rest, and in all cases the current rapidly diminished, but generally recovered again on standing in circuit. A small cell made of crushed rust cones from H.M.S. *Inflexible*, after standing on short circuit for a week, gave a constant deflection of 108°.

These deflections were all much increased when sea water through which carbonic acid and air had been passed was used.

These experiments do not in any way establish the relative electrical relations existing between iron and steel and the oxides, a point which it would take months of careful research to fully clear up, but they do show that rust as we have it on a ship's bottom is quite as capable of setting up galvanic action as the magnetic oxide, even if the action be less intense, and in consequence somewhat slower.

Starting with these data, we can now explain the formation of rust cones and the resulting pitting of the plates. On the metal of our ship we have a small particle of moist rust, left there when the ship was last scraped, or else formed by a particle of some foreign metal or the perishing of the protective. The moist rust forms a galvanic couple with the iron and slowly decomposes the moisture, the oxygen oxidising the iron, whilst the hydrogen gently pushes up the protective and antifouling coats, forming a small blister, the sea water leaks in, an active galvanic current is produced, and the blister slowly fills with the result of that action—rust—and the continuation of the action gives us the large rust cones. This process being independent of the oxygen dissolved in the sea water and the amount of water present being small, the corrosion gives rise to the ferrous as well as to the ferric oxide.

In many of these rust cones the structure is distinctly visible, and one can see that they have been built up in successive layers, each layer of rust as it has been formed pushing up the layer above it.

The larger number of cones existing near the stern and on the rudder may be induced by galvanic disturbances between the bearings of the shaft and the protectors, or to increased activity induced by the air and surface water sucked down by the thrust of the screw, whilst under the bilge they would be due to imperfect scraping.

It being therefore evident that corrosion of this nature is intimately connected with galvanic action, we can now see the points at which we must aim in order to check it.

We may arrange all the metallic elements in a series in which each metal shall be electro-negative to those following it, and whenever two metals are present in an exciting liquid and contact is made between any two portions of the separate metals a current is set up, with a wasting away of the electro-positive metal.

Iron is feebly electro-positive to its oxides, but zinc is strongly electro-positive to iron, so that when zinc is brought in contact with it in presence of an exciting fluid like sea water, the current flows from the zinc to the iron, and the zinc is oxidised, the iron remaining untouched; and this is what happens when zinc is placed in an iron or steel boiler, the galvanic relations between the zinc and the iron are so much stronger than those existing between the oxides of iron and the steel, that the oxides are ignored, and galvanic action takes place at the expense of the zinc.

Having now seen the nature of corrosion in our ships' bottoms, and the steps taken to keep it in check in our steel boilers, let us see how far the protectives in present use are adapted for the purpose.

We may roughly divide protective compositions into three classes:—

(1) Red lead.
(2) Varnishes.
(3) Varnishes to which solidity and body has been given by an admixture of some foreign substance.

The first-class owes the measure of success which is obtained to the fact that the red lead converted the linseed oil with which it was mixed, into a soap, which coated the metal and so protected it; but its use has now nearly died out.

In the second-class we find some of the most successful protectives, good gums dissolved in volatile solvents, which form a closely adhering varnish on the sides of the vessel, and which, if the plates are well cleaned and not sweating at the time the composition is put on, answer very well; but they are open to two objections. The gums which are good to use are expensive, and cheaper ones are often substituted, causing failure in the protection, whilst they have not sufficent body to withstand much wear and tear; and in the third class this body is produced by the admixture of some foreign substance, generally oxide of iron.

From what I know of protectives, and from the facts I have brought before you, there is little doubt in my mind that the protective composition of the future will belong to this last class, and that it will be made by dissolving a good sound gum, not easily perished by sea water, in a volatile solvent, care being taken that neither gum nor solvent give rise to any organic acids; and body will be given to this varnish by finely divided metallic zinc, which can now be obtained in so fine a powder that it can be readily used as a pigment, and will give as good a body as oxide of iron can do.

Now in such a protective the varnish will act for many months, as in the case of many of our present compositions, and when in time the varnish perishes, as it must do from the action of sea water under pressure, then the zinc will set up galvanic action, and will prevent the corrosion of the iron by being itself the substance corroded, and the zinc oxide so formed will form a layer under the anti-fouling, and continue protecting the metal as well as many of the protectives we have in use.

Not only must we use our best endeavours to prevent nature destroying the steel and iron of which our ships are built, but we must remember that in a large number of our anti-fouling compositions we have present copper or copper compounds, and that if we use these we are imposing a still greater strain upon our protective, as any failure or fracture in its surface will cause a deposition of copper on the iron, set up strong galvanic action, and cause serious pitting, a state of things which nothing but metallic zinc in the protective is strong enough to check.

The question of protectives is of very great importance to the Mercantile Marine, but of even more importance to the Admiralty, and at the present moment, with some of the protective and anti-fouling compositions in use in the Navy, it is no exaggeration to say, that in event of a naval war extending over any long period, when frequent docking would be impossible, one-half our fleet would be useless, as far as speed is concerned, before a year had elapsed, from the accumulation of rust, weed, and shell upon their bottoms; and I trust I may secure the co-operation of the members of this Institution in elucidating a question, which is of such vital importance to the well-being alike of the Royal Navy and Mercantile Marine.

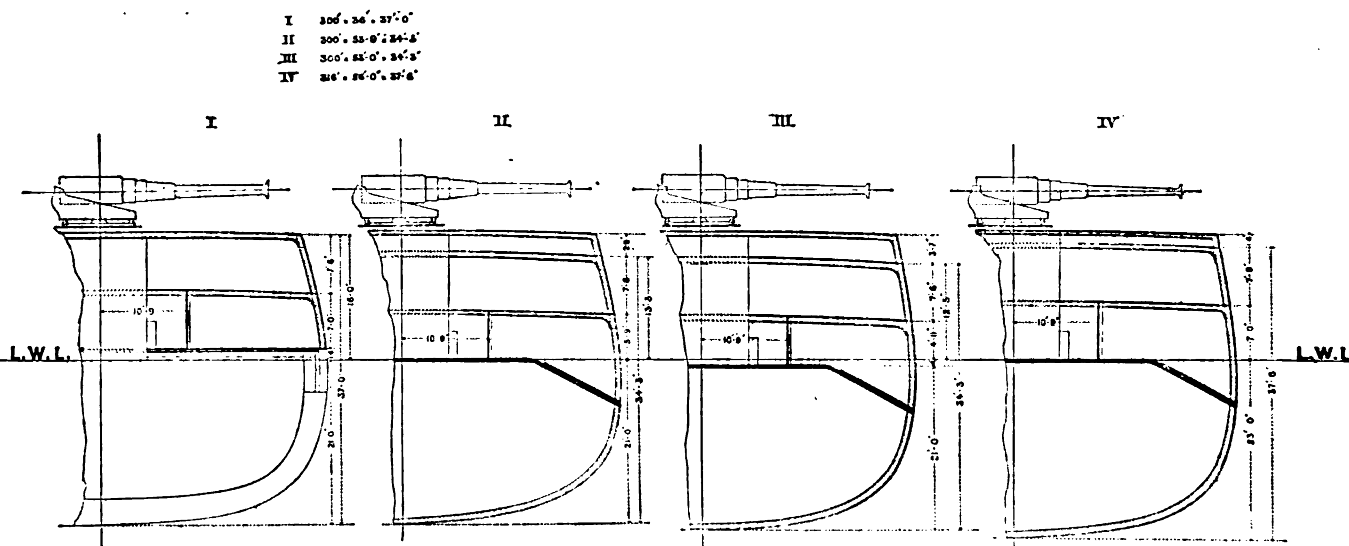
COMPARATIVE EFFECTS OF BELTED AND INTERNAL PROTECTION UPON THE OTHER ELEMENTS OF DESIGN OF A CRUISER.*

By J. H. BILES, Esq.

THE question of the best method of protecting cruisers is a subject which has caused a considerable amount of discussion. The wide-spread interest in naval circles which this question naturally arouses must be my excuse for venturing to bring this subject before this Institution.

The belted type of protection may be described as a belt or strip of vertical armour, forming the side of the ship in the vicinity of the water line, and surmounted by a flat deck of about one-fifth of the thickness of the belt, forming with the belt a shield over the machinery and magazines of a ship.

The internal type of protection is usually represented by a steel deck extending from side to side of the ship, but, instead of ending with a belt of armour, it is sloped down at the side, joining the outside bottom at approximately the same point that the bottom of the armour does. The slooping part of the deck at the side of the ship is usually thicker than at the middle.



A.

If the thickness of the internal deck be properly chosen, it is evident that the protection of the machinery and magazines from the effects of shot and shell fire may be made equal to that of the belted type. But the essential difference between these two types lies in the fact that in the vicinity of the water-line, for a small height, the belted ship offers resistance to penetration, which would be followed by the admission of water, while the protected ship practically offers none. Assuming that it is desirable to have a belt, which some have very emphatically stated to be of vital importance, it is desirable to investigate the effect that the adoption of such a method of protection has upon the speed, cost, and other qualities of a ship, which, but for the adoption of this belt, would have had an equally good protection to her machinery and magazines in the form of an internal curved deck.

To make a definite comparision, I have selected the latest type of belted cruiser which the English Admiralty have built, viz., the *Aurora* type. The particulars of these vessels have been already published, but, for purposes of reference, they are given here:—

	Ft.	Ins.
Length between perpendiculars	300	0
Breadth, moulded	56	0
Depth, moulded at side	37	0
Draft, mean	21	0
Displacement	5,000 tons.	

*Read at the Twenty-eighth Session of the Institution of Naval Architects.

	Ft.	Ins.
Thickness of belt armour	0	10
Do. backing, ...	0	6
Height of belt above L.W.L.	1	6
Depth do. below L.W.L.	4	0
Length of belt, about	200	0
Thickness of deck above belt	0	2

NOTE.—Before and abaft the belt, the deck becomes an internal protective deck, and slopes down at the sides. The thickness of the sloping part is 3 inches, that of flat, 2 inches.

Armament—Two 9·2 B.L. guns, one forward and one aft; ten 6-inch B.L. guns; and a number of small guns.

	Tons.
Coals, normal supply	500*
Do. full do.	1,000*
	Feet.
Metacentric height in intact condition, ...	2*
	Knots.
Speed	1
I.H.P.	8,5

Weights, approximate—

	Tons.
Provisions, stores, outfit, armament, and auxiliary machinery	660*
Machinery and engineers' stores	830*
Protection	880*
Hull and conning tower	2,130
Coals	500
	5,000

Starting upon the basis of these figures, I have estimated the corresponding particulars for a vessel of the protective deck type, which fulfils, as nearly as possible, the same essential conditions as the belted cruiser, except in the matter of side protection.

The comparative assumptions upon which this design is based are:—1. Length and draft of water to be the same. 2. Armament to be the same, carried at the same height above water. 3. Protection to be the same thickness on the flat as the deck of the belted cruiser. The sloped part to be at an angle of 28°, and its thickness, measured horizontally, to be the same, viz., 10 in. 4. Crew to be the same. 5. Metacentric height, in intact condition, to be the same, viz., 2 feet. 6. Speed to be the same. 7. The capacity of coal bunker above the protective deck is the same. 8. Forms to be similar.

*Estimated by the author.

Upon these assumptions, the principal elements of the design will be as follows :—

Design 2.	Ft.	in.
Length between perpendiculars	300	0
Breadth, moulded	53	9
Depth	34	3
Draft, mean	21	0
Displacement	4,790 tons.	

Thickness of belt on slope = 4·69 inches.
Do. flat = 2·0 do.
Height above W. L. at centre = 0 feet 0 inches.
Depth below do. at side = 6 do. 0 do.

Note.—Before and abaft the distance that the belt extends in the belted cruiser, the decks are assumed to be of the same character and thickness in the two ships.

Armament, same as belted ship.
Coals, normal supply = 500 tons.
Do. full do. = 1,000 „
Speed = 18½ knots.
I.H.P. = 8,250.
Weights, approximate—

Provisions, stores, outfit, armament, and auxiliary machinery	=	660
Machinery and Engineers' stores	=	805
Protection	=	675
Hull and conning tower	=	2,050
Coals	=	500
		4,690
Margin of displacement = 100 ..		4,790

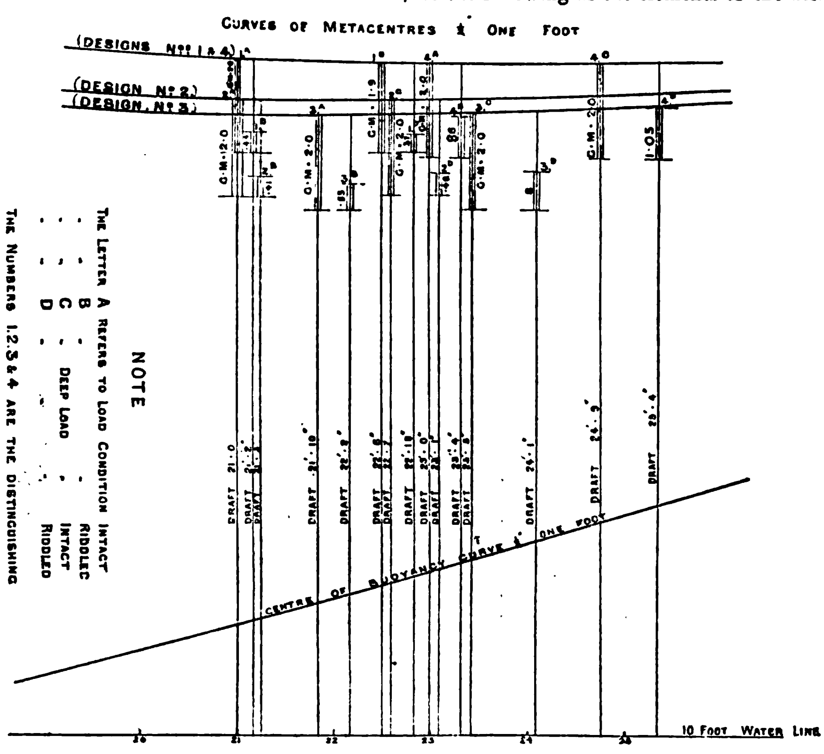
the coal protection in the latter is likely to be greater. Taking these facts into consideration, the fairest comparison for protection of machinery and magazines seems to me to be as in assumption 3. With reference to the bunker capacity, the assumption 7 is based on the consideration that the amount of coal which can be carried is ultimately limited, not by the space available, but by the weight which the commander considers it desirable to carry for the special purpose of the voyage he is about to undertake; and also by the consideration that the best arrangement for fighting is that which gives the greatest proportionate amount of coal above the armoured deck, for a given initial metacentric height. In other words, the lower bunkers should have as little coal as possible, and, consequently, the total space occupied by coal is independent of the difference in size of the lower bunkers in the two ships.

From the foregoing list of weights it has been shown that 100 tons of displacement is to spare, in favour of the internally protected type. This weight is capable of either—

1. Adding 40 per cent. to the thickness of the flat part of the armoured deck amidships:
2. Or adding about a six-tenth of a knot to the speed of the ship.
3. Or adding one 9·2 inch gun and two 6-inch guns to the armament.

But it may perhaps be claimed that, in the comparison of the two types, the condition of equal draught of water should be set aside in favour of that of equal displacements. This would make available a very much larger amount of displacement for additions of the nature of the above.

Dealing only with the second one—increase of speed—and adhering to all the other assumptions, excepting the equality of draft, which is replaced by equality of displacement, we are led to the following as the elements of the design:—



B.

Thus, on above-named assumptions, we have 100 tons more available displacement.

The debatable points of the above assumptions are Nos. 3 and 7. With respect to 3, it may be objected that no credit is given to the plating behind armour and the backing, nor to the fact that the outside armour is steel-faced; but we have to set against these the fact that a plunging shot might strike the 2-inch deck in the belted cruiser, in the part which is occupied by the sloped deck in the protective deck cruiser, and penetrate the former when it would fail to penetrate the 4½ deck of the latter; also,

Design 3.	Ft.	in.
Length between perpendiculars	300	0
Breadth, moulded	53	0
Depth	34	3
Draft mean	21	10
Displacement	5,000 tons.	

Thickness of belt on slope = 4·69 inches
Do. flat = 2 0 do.
Height below W.L. at centre = 0 feet 10 inches.
Do. below do. at side = 6 do. 10 do.
Note.—Decks at ends same as before.

Armament same as belted cruiser.
Coals, normal supply, = 500 tons.
Do. full do. = 1,000 „
Speed, = 20·0 knots.
I.H.P., = 11,600.
Approximate weights—

Provisions, stores, outfit, armament, and auxiliary machinery	=	670
Machinery and engineers' stores	=	1,125
Protection	=	670
Hull and conning tower	=	2,035
Coal	=	500
		5,000

Thus an increase of speed of a knot and a-half may be obtained in the internally protected type over the belted cruiser, on the above assumptions, at the same displacement. In the Design 3, if the protection be added to instead of the power of machinery being increased, about 44 per cent. may be added to the thickness of the whole of the deck plating.

The question of relative cost of the two types is of importance. The *Aurora's* estimated cost is for hull £215,550, and for machinery £64,000, or £279,550. The cost of hull is made up of what may be called the armoured and the unarmoured part. The former consists of the conning tower and protecting tubes, which in all the comparisons in this paper are assumed to be the same—the armoured deck and the armour and backing on the side. I think the unarmoured part of the hull will cost £169,500, the conning tower, protecting tubes, &c., which are the same in all the cases, will cost £6,000, and the armoured deck and side will cost £40,000. The hull is £82·7 per ton, and this rate may be assumed, without great error, for the hulls of the other designs. From this basis the cost of No 2 Design is estimated to be for hull £162,919, for conning tower, &c., £6,000, and for protective deck £10,125, or a total of £179,044. The machinery in this case is £62,060. Total cost of vessel is £241,104, against £279,500 for the belted ship. It is, therefore, evident that, as a question of first cost, the internally protected ship is £38,396 cheaper. In other words, a vessel of much greater size and increased powers of offence and defence can be built for the same money of the internally protected type than of the belted type. I have determined the elements of the design of a vessel of about the same first cost as the *Aurora*, upon the same data as above, and they are shown in Table A, Design 4, the other three designs being placed with this one for facility of comparison:—

No. 4 Design.—Cost of Hull	.. ..	=	£172,000
„ Conning Tower, &c.		=	6,000
„ Deck Protection	..	=	15,000
„ Machinery ..	..	=	86,600
			£279,600

From the above it will be seen that for about the same cost a vessel of the internally protected type can be built with 20 per cent. more protection on the slope, 50 per cent. more on the flat, two more guns of the heaviest calibre, 50 per cent. more coal, and a knot more speed. The belted ship has the advantage of the reduced length and draft, but this can be also had in the internally protected type, as in the smaller size, with the additional advantage of a greatly reduced cost.

We are now naturally led to ask the question:—

1st. Is the adoption of the belt worth the extra money paid for it, with its accompanying sacrifices?

2nd. If the money is to be spent, is the belt worth the sacrifice of speed, protection, and armament which is entailed in its adoption?

The protection of the machinery and magazines from shot and shell fire is not very different, I venture to think, in the two cases. The only other question is that of protecting the buoyancy and stability by armour; but it is extremely difficult to see how a narrow strip of armour projecting, on an average, a foot and a-half out of the water, and four feet under it, can be said to be likely to help to exclude water from a ship, in which the side both above and below these points, will hardly keep a rifle bullet out. The sea is not so respectful to a naval architect's load line as to make its surface conform to it at all times; and it is difficult to understand how any naval officer would agree to sacrifice anything in order to have the assurance that his ship's side might not have a hole in it at the average still water load line, but was liable to have one that a horse and cart could drive through at a foot and a-half above that line.

The question of the effect upon the stability of the two types by penetration of the unarmoured side, immediately above the armoured protection, may be seen by reference to Fig. B. The metacentric diagram in each of the four cases discussed is given. It is assumed that the normal amount of coal is on board, that the reduction of weights of stores, &c., due to having been at sea for some time, is compensated for by water ballast. It is also assumed the compartments shown in Fig. C are damaged, and that, in order to keep the ship upright, the corresponding

	No. 1.	No. 2.	No. 3.	No. 4.
Length	300	300	300	316
Breadth	56′ 0″	53′ 9″	53′ 3″	56′ 0″
Depth	37′ 0″	34′ 3″	34′ 3″	37′ 6″
Draft (mean)	21′ 0″	21′ 0″	21′ 10″	23′ 0″
Displacement	5,000	4,790	5,000	5,800
Thickness of Belt	10″	4·69″	4·69″	5·63″
„ Backing	6″	..	..	..
Top of Belt above or below water ..	above 1′ 6″	0″	below 10″	0″
Bottom „ below water	4′ 6″	6′ 0″	6′ 10″	6′ 0″
Length of Belt	200	200	200	230
Thickness of Deck	2″	2″	2″	3″
Armament	2-9″ guns 10-6″ guns	2-9″ guns 10-6″ guns	2-9″ guns 10-6″ guns	4-9″ guns 10-6″ guns
Coals (normal)	500	500	500	750
„ (full)	1,000	1,000	1,000	1,200
Speed	18½	*18½	20·0	19½
I.H.P.	8,500	*8,250	11,600	11,500
Metacentric Height in load condition	2·0	2·0	2·0	2·0
Weights	..	..	..	..
Provisions, Outfit, Armament, &c...	660	660	670	772
Machinery and Engineer's Stores ..	830	805	1,125	1,118
Protection	880	675	670	1,000
Hull and Conning Tower	2,130	2,050	2,035	2,160
Coal	500	500	500	750
	5,000	*4,690	5,000	5,800

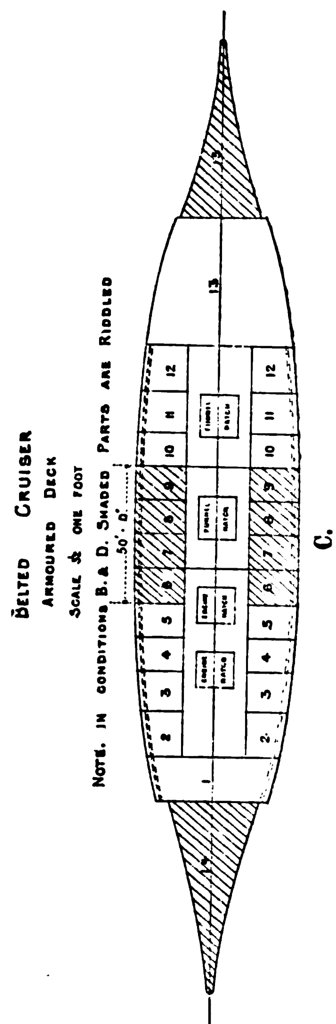
* If the 100 tons surplus displacement be used for machinery, speed will be 19·1 knots.

compartments on both sides are in communication with the sea. It is also assumed that the motion of the sea and the ship is sufficient to cause the water to enter freely the holes made in the side. In these conditions, and on these assumptions, it will be readily seen how much remaining stability there is in each case.

In Fig. B the metacentric heights are shown on the same assumption as above, excepting that it is assumed that the vessels have each their full quantity of coal on board.

The following Table shows clearly the amount of metacentric height, with the same amount of riddling in each case:—

	No. 1.	No. 2.	No. 3.	No. 4.
Load Condition, intact—A ..	2·0	2·0	2·0	2·0
Do. do. riddled—B ..	0·44	0·41	0·55	0·86
Deep Load Condition, intact—C	1·9	2·0	2·0	2·0
Do. do. do. riddled—D	0·37	0·48	0·8	1·05



The amount of metacentric height remaining, after riddling, is a proper measure of the protection to the stability afforded by each method of protection, and it will be seen that the percentage differences are very considerable. Another method of looking at this is, by showing approximately how many compartments may be riddled in each case before the metacentric height becomes zero. Starting from the deep load condition in each case, the Designs 1, 2, 3, and 4, will have no metacentric height when the bunkers are flooded on each side for a length of 79 ft., 86½ ft., 93 ft., and 93 ft. respectively.

I have ventured to put these facts before the Institution in the form in which they have presented themselves to me, but they do not, by any means, exhaust the question, and I hope that they may lead to the eliciting of many other facts in the discussion of this interesting question.

THE NEWCASTLE - UPON - TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

JUBILEE YEAR, 1887.

(*Continued from page* 86.)

THE Phosphor Bronze Company, Limited, 87, Sumner Street, Southwark, London, have their stand in close contiguity to the varied collection of ropes, described in our last issue. The varied exhibits displayed by the above-mentioned Company give some idea, though it be but a faint one, of the many and diverse purposes in which this important metal is now employed. Not the least interesting are the phosphor bronze worn crank shaft bearings, which show how very gradual and evenly this metal wears, and how it preserves all its pristine excellent qualities, until it is positively as thin as a sixpence. In the similar exhibit of piston rings made from phosphor bronze there is also an object of attraction for marine engineers, as after being a considerable time in use, there is not the slightest trace of any wear having taken place. Now that a higher pressure of steam, and an increased number of revolutions is fast becoming quite *à la mode* the important qualities of phosphor-bronze will be found to give special advantages when it is used in the manufacture of piston valve rings, &c. Those exhibited after being nearly two years in use show scarcely the least signs of wear, and there is no difficulty in so proportioning the ingredients, copper, tin, phosphorus, &c., so that alloys may either be as ductile as copper, as tough as iron, or as hard as steel. Several of the most important exhibits were on view at Liverpool last year, when we referred to them at considerable length on pages 150 and 151 of our August, 1886, number, but amongst those we specially noticed at Newcastle-on-Tyne were thrust rings, for the thrust bearings of marine engines, for which phosphor-bronze is specially adapted. A large propeller of phosphor-bronze alloy II is an imposing sight and cannot fail to attract the eyes of visitors as they pass the stand on their way out to the North Gardens by the central door, in the North Court, and an inspection of a large propeller bolt 6½ in. diameter lying alongside will be replete with interest, it being one of the type supplied to Her Majesty's Navy. The specimen springs manufactured from rolled and drawn phosphor bronze and silicium bronze, should not be overlooked in inspecting the countless variety of exhibits shown by this enterprising company. Engineers who indulge in horse-riding will find in the cases of miscellaneous exhibits very elegantly finished stirrups, which have, as all materials made of Phosphor Bronze have, the invaluable qualities of non-corrosion or tarnishing. Although not of special interest to marine engineers, as such, but to all classes of engineers or shipbuilders having to do with electric fittings, the silicium-bronze wire exhibits should not be forgotten. The National Telephone Company were the first to use light wire in this country, in February, 1882, when they adopted No. 20, B.W.G. phosphor bronze, but for the last four years No. 18 B.W.G. silicium-bronze has taken its place. The latter weighs only 38 lbs. to the mile, and has a breaking strain of 2 cwt. No record of an accident, however trifling, has been recorded by the breaking of one of these wires. At Prague, over the River Moldau, there is a span of 430 yards crossed by seventeen silicium-bronze wires, and it was not until three years expired that the first breakage occurred, in December, 1886. Need more be said to show the immense superiority of this special wire, manufactured by the Phosphor Bronze Company. Mr. George Noble of 1, Akenside Hill, Newcastle-on-Tyne, is the sole agent of this Company for the Tyne and Wear districts, and as we believe is widely known the Phosphor Bronze Company has works at London, Birmingham and Liverpool.

Messrs. Douglass Bros., Limited, of Blaydon-on-Tyne, have a large collection of the specialities they manufacture. The most important to most of our readers is without doubt their patent furnace front for marine and other boilers. Some time ago we

fully described and illustrated this furnace front, but recently a modification has been made in its construction, with the intention of further improving its efficiency. The alteration consists in introducing a casing inside the furnace door, and inside the furnace front above the door, small holes being in the casings to permit the air, after having been heated, to pass into the furnace. Numerous exhibits of smith-work for ships' rigging and outfits, colliery, engine and other work, including a splendid assortment of internal bindings for blocks, show the first-class character of the smith work executed by Messrs. Douglass. Besides exhibiting casting of all kinds, a model roof, with columns, lattice girders, &c., complete, and other forgings and castings, they show Rockliffe's patent ships' doors, for deck houses, cabins, galleys, &c., which have passed into general use in many shipbuilding yards. Douglass' patent railway couplings for railway traffic are also amongst this Company's exhibits.

Messrs. Smith Brothers & Co., Hyson Green Works, Nottingham.—This firm have in a glass case a large and beautifully finished collection of a vast variety of their specialities, comprising their steam pressure vacuum, hydraulic gauges, and other gun-metal steam fittings, including steamers' whistles. Their patent sound signal whistles, the harmony, octave, and treble tone, are now extensively used by all the leading steamship owners in all parts of the world. The harmony, which gives a very loud penetrating sound, very musical to the ear, has quite superseded the old-fashioned shrieking buzzer, and is now being

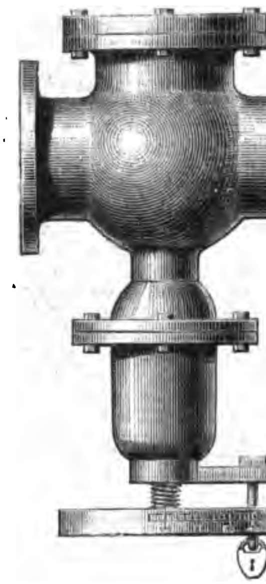
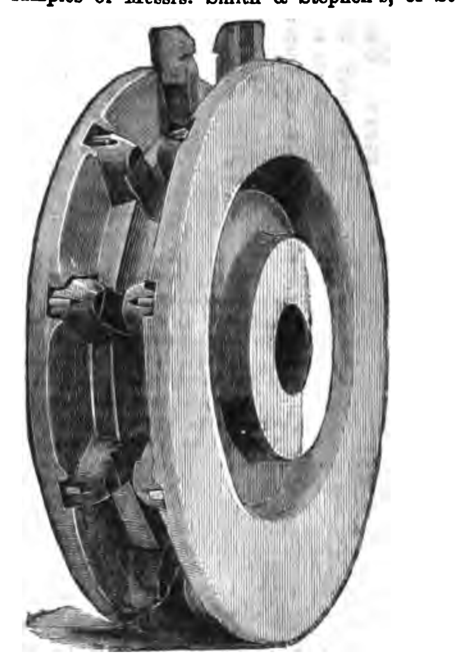


Fig. 1.

adopted as a workman's call at mills, iron works, collieries, &c.; also at hospitals as a fire alarm. The collection of steam gauges, &c., is of an extremely varied nature, and specially interesting and instructive, as it partakes of a historical character. Amongst these exhibits is the fifth steam gauge ever made. It was constructed in accordance with the original Smith's patent, 1847, and has been in use at a colliery near Sunderland for nearly 30 years, and is still in good condition. The late George Stephenson, of locomotive engineering renown, was one of the first engineers to put Smith's original patent steam gauge to a practical test, and always spoke highly regarding its efficiency; but looking upon this relic of the by-gone past, with its brass dial engraved with every 5 lbs. up to 100 lbs., and with its sheet brass case, and then turning to the artistic silver-plated cast case, with the porcelain or patent enamelled dials, of the steam gauges now manufactured by Messrs. Smith Brothers & Co., all finished to the accuracy and perfection of a watch, the visitor will be able to form some idea of the great improvements that have been effected in recent years in the manufacture of these indispensable engine and boiler fittings, and especially to what this firm in particular has attained in the style and finish of this class of goods. A specialty of Messrs. Smith Brothers & Co., which we illustrate in Fig. 1, is their patent improved self-acting reducing valve, for obtaining steam of low and uniform pressure, where steam may be required, at a lower pressure than that in the boiler. Owing to the ever-increasing use of high pressure steam by the introduction of the triple-expansion engine, there is a growing demand for a reliable valve of this description; and the one we now illustrate is being largely adopted by the largest firms of marine engineers, also by the Admiralty and several foreign governments. This valve appears to be the simplest and most effective now in use, and it is quite automatic. All the working parts of this valve being encased prevents the occurrence of corrosion so injurious to articles of this class, when the working parts are exposed to escaping steam, &c. There is also exhibited by Messrs. Smith Brothers & Co. a unique collection of sight-feed lubricators, oil cups, &c., varying in size and arrangement from the small oil-cup suitable for tiny model engines to the large sight-feed lubricators, having a capacity of one gallon. The latter class of lubricators have a patented arrangement for preventing the breaking of the glass by expansion, are now fitted to the engines of the largest construction, including the extensive pumping engines of the Severn tunnel, &c. All these articles are highly finished, and made of the best gun-metal. In the lower part of the glass case Messrs. Smith Brothers & Co. exhibit a large array of articles for plumber work on board ship, &c., including an assortment of high pressure bib and stop cocks, also silver plated bath and lavatory fittings, &c. One of the most prominent of these exhibits is a section of a patent porcelain-seated water tap, which has been specially brought out for hot water purposes, and the simplicity of the enamelled porcelain seat is evident, as it can be removed with an ordinary screw-driver by even an inexperienced person. This exhibit is worthy of the attention of shipbuilders, shipowners, &c., who require a good sound water-tap, especially for salt water baths, lavatories, &c. On the floor at each end of their case Messrs. Smith Brothers & Co. have iron stop valves, full bore valves, &c., all of modern design, and which have been tested to very high pressures. They are all of superior finish, although not so attractive to the eye as the gun-metal exhibits previously described. It may be stated in leaving the exhibits of Messrs. Smith Brothers & Co. that they are contractors to the Admiralty, various foreign governments, and the principal home and colonial railway companies. They are represented at their stand by Messrs. Cockburn Brothers, of 1, St. Nicholas Buildings, Newcastle-on-Tyne.

Adjoining the last-mentioned firm's exhibits we notice a stand with a large wheel in the centre of it, and several wheels of smaller diameter arranged round it, making a very effective show. These are samples of Messrs. Smith & Stephen's, of St. John



Street, Sunderland, patent interchangeable chain wheel, and especially designed for use in connection with messenger chains on steam winches and windlasses, and also in connection with steering gears or any similar purpose. A common chain wheel exhibited at Messrs. Smith & Stephen's stand, which has seen service, shows how the ordinary wheel of this description is soon rendered useless by the wearing of the teeth, and often in less than

two years is condemned, and has to be replaced by a new one. Clearly the teeth in a chain wheel is the vulnerable part, and the novelty in Messrs. Smith & Stephen's patent interchangeable chain wheel, which we illustrate in Fig. 1, will be seen to consist in having the teeth made independent of the body of the wheel, and of malleable cast iron. They are fitted into grooves and secured by pins. It may naturally be expected that such teeth will wear longer than ordinary ones cast of the common brand of iron along with the main part of the wheel; and further, there is the manifest advantage that when a tooth does wear it can be readily removed, and a new one fitted, by even an unskilled person. At the the top of the wheel, in our illustration, a tooth is shown partially entered, and while the method of fitting these teeth is simple, it is effective. All the teeth in a wheel are interchangeable, and spare ones can be carried on board the vessel; in fact, in every case where this wheel is ordered, which it has been for over seventy vessels, such a practice is general. It should also be pointed out that to remove or fit a new tooth it is unnecessary to remove the wheel off the shaft on which it does duty, a matter of great importance, seeing how frequently winch shafts are bent, and even in some cases broken, in removing the ordinary chain wheels. We need not say more regarding this patent interchangeable chain wheel of Messrs. Smith & Stephen's, as, to every marine engineer and ship's officer, its advantages will be at once manifest, and we feel assured it will be increasingly adopted on board steamers and sailing vessels.

Mr. Wasteneys Smith, of Sandhill, Newcastle-on-Tyne, has a large number of exhibits illustrative of his Patent "Stockless" Anchor, including a number of anchors for yachts and other small craft. Mr. Wasteneys Smith deserves credit for being foremost in overcoming the difficulties of designing a stockless anchor, of which a detailed description is unnecessary, as this speciality is well known. It may, however, be pointed out, as will be seen from our illustration, Fig. 1, that the steadying point in his patent stockless anchor is at the extreme end or crown, and consequently it is much less liable to turn over than similar

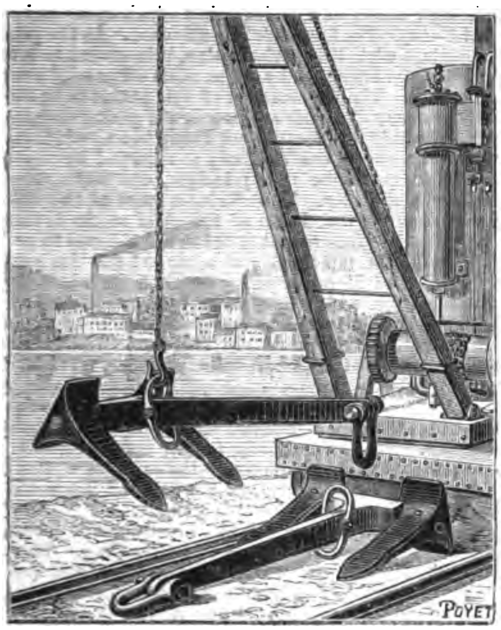


FIG. 1.

anchors having bow-shaped arms working in a central pivot. Upwards of one thousand of these anchors have been made, some of them exceeding 6 tons in weight. They have been supplied to many of Her Majesty's ships, and also to the war vessels of foreign nations, including the far-famed Chilian cruiser *Esmeralda*, and the Japanese cruisers the *Naniwa Kan* and the *Takachiho Kan*. There is no greater test usually given to anchors in actual work than that experienced by those that are fitted on our large Atlantic mail and passenger steamships sailing out of Liverpool, as these vessels have to lay at their moorings in the River Mersey, and be subject to cross currents, and a heavy rise and fall of tide. It is therefore no slight recommendation for these patent stockless anchors that after nearly eight years' use in all the steamers of the Cunard Line sailing out of Liverpool, there has not been an instance of their moving, notwithstanding the exceptionally large size of the Cunard Company's steamers. These anchors have been largely adopted by yachting sportsmen, for every species of vessel from the tiny canoe to the largest privately owned yacht afloat, the screw steamer *Alba*, of 1,300 tons. The lately-launched *Thistle*, of which there are great expectations, is among the large number of celebrated yachts that carry these anchors. They are also frequently supplied to steam launches and torpedo boats, and form part of the equipment of the large submarine vessel invented and designed by Mr. Nordenfeldt, built by the Barrow Shipbuilding Company. Amongst the exhibits of Mr. Smith are two models of 6½ ton anchors made to scale, one being of Wasteneys Smith's patent, and the other of an ordinary anchor, Admiralty pattern. These models are placed side by side for comparison, and the advantages possessed by the former may be easily discerned. There are also two models showing the fore end of two steam vessels, viz., that of H.M.S. *Agamemnon* and of an ordinary mercantile steamer, built by Messrs. J. L. Thompson & Sons, Sunderland, in which these patent stockless anchors are arranged to stow, partly drawn up, hawse pipes of the ordinary size and construction. Arrangements of this kind for carrying the anchors

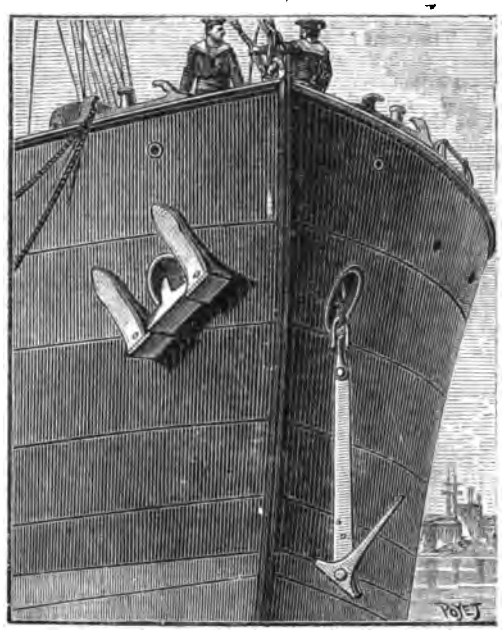


FIG. 2.

of iron and screw steamers and sailing vessels are coming much into vogue, as can be seen in the course of the visitor's inspection of recently built vessels' models. In our second illustration, that of the bow of the s.s. *Emilie*, we see in that vessel the anchors are stowed up the hawse pipes, nothing but the flukes remaining outside, and these lying flat against the skin of the vessel. No alteration is required to be made in the construction of the bow of a steamer to carry out the method shown in Fig. 2, the only variation being that the hawse pipes are made slightly larger to admit the anchor shank. The advantages accruing from this system are easily perceived, and will be readily appreciated by seafaring men. Catting and fishing is entirely dispensed with, also the lashing of the anchors, a work of great risk and difficulty, if immediately on leaving, *e.g.*, the Mersey, as the writer recollects on a memorable occasion, at once a severe storm has to be faced, while the steamer is going full speed ahead. With the anchors up, the hawse pipes securely held by the heavy chain cables, no better form of stowing is required, and any risk of damage to other vessels when lying alongside in dock or elsewhere is merely imaginary. A great advantage is, the anchor is always ready to be lowered, and there is no delay in getting up steam, &c., in order to lift the anchor from the deck and get it over the side. From a shipowner's point of view there is the reduced first cost and frequent renewals of parts of anchor cranes, davits, blocks, falls, catting

and fishing gear, &c.; and to the officers on the bridge there is the advantage of less obstruction to their line of sight forward by the dispensing with the just-mentioned fittings. It should be pointed out that these anchors are now usually made of steel by the sole makers, Messrs. John Spencer & Sons, Newburn, the well-known specialists in steel manufacture. The last-mentioned firm at their stands have larger exhibits of Wasteneys Smith's anchors, such as were supplied to the Atlantic greyhounds *Umbria*, *Etruria*, &c. There need be no fear on the part of shipowners that steel anchors are less reliable than those made of iron. Not only have steel anchors to undergo the ordinary test at Lloyd's testing machines, they have also to be subject to exceedingly stringent tensile, bending and drop tests, these being carried out under the closest supervision of Lloyd's surveyors especially appointed for that duty; tests that would in all probability frequently prove fatal to iron anchors. Mr. Smith is not content to rest on laurels earned in the past. He is at present bringing before the notice of the yachting world a modification of his patent anchor which should enhance its present efficiency. This consists of constructing the anchor in two parts only, the arms and crosshead being in one piece, with the shank pivoted through it, the whole forming a compact and serviceable anchor, with entire immunity from fouling.

Messrs. Sydney Smith & Sons, of the Basford Brass Works, Nottingham, is another firm who have a very unique display of various specialities which they manufacture for marine and land engineers. The name of Sydney Smith has been so long favourably known in engineering circles that it appears almost unnecessary to draw attention to the high quality of work for which they have so long been celebrated. Mr. Sydney Smith, the late principal of this firm, is generally acknowledged to have been the inventor of the steam pressure gauge in the year 1847; and among many other inventions due to his fertile and constructive ingenuity, that of the rotary steam engine and spring safety valve stand out prominently. Mr. S. Smith was also one of the first to construct barges of iron for canal traffic; but the firm which has inherited his name are not satisfied to rest content with the laurels he gained in by-gone years. At the International Inventions Exhibition, 1885, they were awarded a prize medal for their various patents and specialities in engine fitting, and at the Liverpool International Navigation Exhibition, 1886, they also received a prize medal for superior workmanship. As already

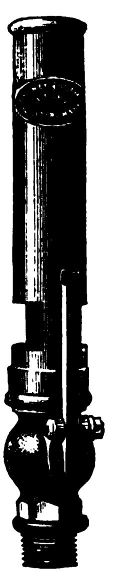


Fig. 1.

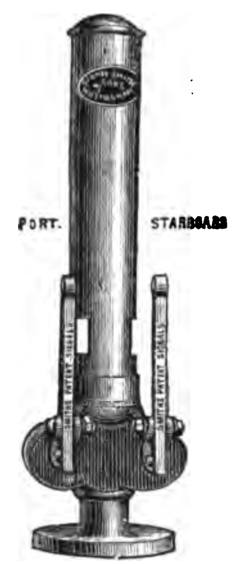


Fig. 2.

indicated, their exhibits at Newcastle-on-Tyne are of an attractive character. We illustrate a few of the principal:—Fig. 1 represents the "Harmony," and fig. 2 the "Octave" form of Smith's Patent Sound Signal Whistles, for which the only awarded prize medal for this class of steamers' outfits was awarded at the Inventions Exhibition, London, in 1885, and at the Liverpool Exhibition last year. Their sizes vary from 1½ in. to 4 in. diameter, and they have, owing to their efficiency, become very popular. The next illustration (fig. 3) is of Smith's patent combined safety valve and steam pressure gauge. The arrangement of this speciality of Messrs. Sydney Smith & Sons requires no further description, as our readers will at a glance comprehend its use. We understand that this apparatus has been tried by several first-class firms, and that so pleased were they with it that a number of repeat orders resulted in each instance. Another important exhibit of Messrs. Sydney Smith & Sons is their patent full-bore taps, which give the same thoroughfare as the bore of the

Fig. 3

pipe. This tap consists of a conical plug which opens and shuts by means of the spindles to which it is attached. As the pressure comes into contact with this conical valve, it is caused to revolve, and this prevents its being cut by sediment or other solid accumulation in the fluid. The appreciation of this patent is best stated by the fact that *many thousands* are now in use giving the greatest satisfaction. Smith's Improved Test Pump is a novelty, and we do not remember seeing one similarly constructed by any other maker. It is made on the ram principle, and works by compression of air and water. The slightest turn of the wheel is indicated in lbs. or tons, and one of the chief merits is that the pressure put upon the instrument tested is not allowed to go back unless liberated by a tap fixed and arranged for the purpose. Another speciality of Messrs. Sydney Smith & Sons is a Duplex Standard Test Gauge, which consists of two strong steel springs with two independent movements, each independent of the other, and acting as checks to one another. There are also on the stand of this firm a variety of ordinary steam pressure, vacuum, compound, and hydraulic gauges, brass pillar marine boiler water gauges, sight feed lubricators, injectors and ejectors, iron junction valves, &c., which pressure on our space precludes us from describing. We have already in our remarks given some indication of the valuable character of the exhibits of this firm, and feel assured most of our readers would be interested in a visit to Messrs. Sydney Smith & Son's stand.

Again we meet with modern exhibits illustrative of locomotive engineering, and also of railway-carriage building. These are exhibited by the North Eastern Railway Company, and are evidence that for enterprise, design, and workmanship, this great Company is not behind its compeers. Many visitors feel proud of the character of the exhibits of the North Eastern Railway Company. From many points of view the most important is the four wheels coupled express compound passenger engine, complete with tender. The total length of the frame plate of this engine is 25 ft. 11 in., the length of the barrel of the boiler, 10 ft. 7 in. As already indicated, in this engine the compound principle so common in marine engineering has been adopted, in accordance with the patent system of Worsdell and Von Borries. The engine was designed by Mr. T. W. Worsdell, locomotive superintendent of the North Eastern Railway Company, and constructed by that Company's workmen at their establishment at Gateshead, and is intended to run on the main line express passenger service between York, Newcastle, and Edinburgh, on which it has been running for three months, since it was turned out of the shops. The diameter of the high-pressure cylinder is 18 in.; low pressure,

26 in. The diameter of the four coupled wheels, 6 ft. 8½ in.; and of the two driving wheels, 4 ft. 7½ in. The working pressure of steam in the boilers is 175 lbs. per square in.; the area of the fire grate is 17·3 square ft.; the number of tubes, 242 of 1⅝ in. diameter, giving 1,211·3 square ft. of heating surface, the firebox supplying 112 square ft.; in all, 1,323·3 square ft. The height from the rails to the top of the chimney is 13 ft. 1 in. in this express engine, as it is also in the compound goods engine, of which detailed drawings are shown, along with those of the former engine. It may be interesting, briefly, to contrast these recently built compound locomotive engines. In the goods engine, instead of the wheels being of different diameter, all the six wheels are 5 ft. 1½ in. diameter on the tread, while the length of the engine is very slightly shorter. The working pressure of the boiler is 160 lbs. per square inch, and while the area of the fire grate is practically identical with the express engine, owing to there being a smaller number of tubes—205 of 1⅝ in. diameter; the tube surface is 1,026·12 square ft., which, added to 110 square ft. for the firebox, gives a total tube and box heating surface of 1,136·12 square ft., as against 1,323·3 square ft. in the express compound engine. Attached to the last-mentioned engine and tender is a standard six-wheeled saloon carriage, equipped with all modern conveniences and continuous brakes, which has been constructed in the North Eastern Railway Company's workshops at York. As might be anticipated, the greatest amount of care appears to have been exercised in making this exhibit as presentable to the eye as possible, and one of the attractions in connection with it, and the engine already described, is, that at night-time it is lighted by the electric light, as is also the danger, &c., lights on the engine.

Mr. F. Leddicoat, Pipewellgate, Gateshead, has a large variety of iron and steel rivets on view, including a number of tested ones, showing the high quality of Mr. Leddicoat's manufacture.

Next we come to a larger display of exhibits, that of Messrs. R. B. Charlton & Co., of the Manor's Brass and Copper Works, Newcastle-on-Tyne. Here we see besides brasswork and fittings for collieries, a large number used by shipbuilders and engineers, &c., comprising bells, sidelights, stopcocks, hydraulic pumps, steam-gauges, patent hose-couplings, &c., all of a high class. Messrs. Charlton also show as interesting to visitors samples of copper, tin, zinc, lead, antimony and nickel, so that altogether this stand is well worthy of a visit.

Messrs. Thomas Walker & Son, of 58, Oxford-street, besides showing their patent detaching hooks for the prevention of accidents from over-winding, exhibit a number of specially well-finished steam-pressure and vacuum-gauges, speed-indicator, &c.

Passing over a number of stands as being devoid of interest to our readers we see that Messrs. Nicholson Brothers, of Hebburn, show portions of an uncompleted boiler of the Lancashire type. The front of the boiler, which is about 6 ft. 6 in. diameter, is all complete, with furnace doors, water gauge, glasses, and steam pressure, gauge, and portions of the furnaces are also exhibited. Evidently this firm is capable of turning out first-class boilers of this type.

In reviewing the wire rope exhibits in our last number we overlooked the exhibits of Messrs. D. H. & G. Haggie, of Sunderland, whose stand is higher up the North Court than those of the firms we then noticed. Although not so extensive in the number of articles shown, special interest is attached to this firm's exhibit of their patent protector rope, for which the advantage is claimed, that the strands being protected by means of a steel spring are prevented from being worn by friction, leading to a prolonging of the life of the rope. One of their patent protector wire ropes is shown on a reel at Messrs. D. H. & G. Haggie's stand, and as will be readily admitted, is a splendid exhibit. This firm has a large trade both at home and abroad, and is at the present time one of the most actively employed, having considerable orders for China, &c.

In the same neighbourhood there are a number of exhibitors of lubricants. Mr. John Sandeman, of Ruchill Oil Works, Glasgow, makes a speciality of mineral greases and resin oils.

The Dee Oil Company, of Chester, exhibits various kinds of engine, machinery, and shafting oils, cylinder oils, and valvolines, gas engine oil, dynamo oil, besides other of their manufactures, making altogether a very effective show.

Crichton's Oil House, of Newcastle-on-Tyne, whose wells and refineries are at Baku, on the Caspian Sea, Russia, have a very interesting and attractively-arranged stand. This company has a wide reputation for refining hydro-carbon oils, and their lubricants are respectively named Caspian, Caspilene, and Volgalene, all of which are exhibited. It is stated that these oils have been thoroughly tested on every description of machinery and leather, and have yielded substantial proofs of their efficiency. As a proof that they are free from acid six pieces of steel are shown immersed in Caspian oil, and have been in that condition since November, 1886, without even showing a trace of tarnish. Oils specially adapted for spinners of woollen yarns are also exhibited, and it is claimed for them that they are neutral, stainless, and perfectly safe. Burning oils, petroleum, and paraffin of the best brands for illuminating purposes, with the very highest safety tests are also among the exhibits on the stand of Crichton's Oil House.

Messrs. R. Henzell & Co., of the Northern Oil Works, Close, Newcastle-upon-Tyne, are also exhibitors of hydoo-carbon lubricants, of various qualities, suitable for all kinds of machinery. They also have on view specimens of olive, gallipoli, colza, fish, linseed, creosote, and other oils, leather belting, india-rubber valves, asbestos, red rope, and various kinds of packings, including the well-known Tuck's patent.

Price's Patent Candle Company, Limited, Belmont Works, Battersea, London, S.W., at their splendidly-arranged stand, amongst their other specialities are also exhibitors of gas engine, and other machinery, oils, &c.

We have previously referred, in our June number, to the exhibits of Messrs. Engelbert & Co., 70, Bishopsgate Street, London, and besides that firm and those already mentioned, lubricating oils are also exhibited by Messrs. Barton, Parr & Co., of Orchard Street, Newcastle-upon-Tyne, whose speciality is the "Express" oil; and Messrs. A. B. Fleming & Co., Limited, Oil Merchants, Caroline Park, Edinburgh, who have on view their patent solidified oil, besides spindle loom, engine, cylinder, and valve oils, &c.

Messrs. Bailey Brothers, of 25, Chancery Lane, London, E.C., have their stand in the neighbourhood of those just alluded to. One of their special exhibits is strong fish-glue cement, for joining millbands, &c., which secures a perfectly smooth and even splice, and is specially suited for bands used in connection with electrical machinery, and other similar high-speed work.

Next in order to the last mentioned is the exhibits of Mr. George Glover, of the Water Purifying and Scale Prevention Works, Wallsend-on-Tyne. Incrustation is well known to be uneconomical, whether in land or marine boilers, and is not confined to those which are fed by salt water. It has been estimated that the presence of a quarter of an inch of scale leads to a decrease in the efficiency of fuel of 32 per cent., and a half-inch scale decreases the full efficiency 50 per cent., so that it can be easily realised how important it is to avoid incrustation. Mr. Glover has sought to do this, and evidently with considerable success by a preparation for purifying the feed water of steam boilers, determined on chemical principles, and varying in its constituents according to the impurities in the feed water. More especially for water tube boilers has this Glover's compound been found to be efficacious, but it has also been successfully used in ordinary land boilers, at many of the principal shipbuilding, engineering, glass, cement, and other works on the river Tyne. Special preparations are supplied by Mr. Glover where salt water is used for feeding the boilers, and evidently by bringing to his assistance a wide knowledge of chemistry this gentlemen has met with abundant success in overcoming the great drawback to economical steam raising, of incrustation.

As might be expected, at the stand of Messrs. Charles Cammell and Company, Limited, of the Cyclops Works, Sheffield, we see a fine and effective display. The excellency of the manufactures of this firm are too widely known for it to be necessary to give a detailed account of their exhibits, which at the best give the visitor but a slight idea of the important character and great extent of the Cyclop Works. A mere dry recital of the various objects exhibited would also be out of place, even if the pressure on our space would allow of it. No visitor can, however, overlook the forged steel crank shafts, the cast steel propeller blades, the armour bolts, steel projectiles and shells, and the section of hollow forged gun jacket, which, however, form only a modicum of the vast variety of articles exhibited by Messrs. Cammell & Co., Limited. We also venture to draw attention to the choice assortment of bearing, volute, conical, and spiral springs, as being some of the finest exhibits we have ever seen.

The next exhibit we come to is contributed by the River Tyne Commissioners. It illustrates the mode of carrying out the work of building the large piers which protect the entrance to the River Tyne, and which have done so much to improve the navigation and safety of access to the ports of Shields and Newcastle. It is a working model of a mammoth crane, on the scale of one inch to the foot, which is now, and has been for some time, in use for extending the South Pier at the mouth of the Tyne. In respect to the weight it usually manipulates, it is similar to the one which the River Wear Commissioners exhibit, and which we have

already described at length. A brief description must therefore suffice for this crane. It was constructed to set blocks, and bags of concrete weighing 45 tons, at a radius of 92 ft. and projection or overhanging of 75 feet. The crane was constructed at the Tyne Commissioners' Works, the engine, lifting and turning machinery being supplied by Messrs. Stothert & Pitt, of Bath, and the whole designs and arrangements were delineated by Mr. Phillip J. Messent, Engineer to the Tyne Improvement Commissioners. The next exhibits to attract our attention are again of a diverse character to those we have just alluded.

Mr. John Dickinson, of Sunderland, the well-known marine engineer and boilermaker, has only one exhibit at this exhibition, but it is of such a highly finished and attractive character that although it is only a crank shaft it elicits universal praise. This crank shaft has been specially designed and constructed for marine engines of the triple-expansion type, and is in accordance with Dickinson's patent. The construction of a crank shaft as patented by Mr. John Dickinson is now well-known. The webs and crank pins are all of cast-steel, the straight portions of the cranks can be of forged iron or forged steel. Couplings proper are dispensed with as the crank webs are made to discharge this duty, so enabling the total length of shafting to be shortened, and in case of a crank pin giving out, the amount of repairs requiring in replacing it, is reduced to a minimum; similarly, if the straight portion of the shafting should break or prove defective, the cost of replacing it and delay in obtaining a new portion is materially reduced. Dickinson's Patent Crank Shaft has been approved by the Board of Trade, the Committee of Lloyd's Register, and the Bureau Veritas. It has been fitted to the engines of nearly one hundred vessels, and is in constant demand. Besides the advantages already indicated, it is claimed that it is essentially a built shaft, being more easily taken to pieces and put together than any other shaft extant. As can be readily understood the possibility and probability of sound forgings is materially increased by these being short, straight and in easily handled lengths. It is also evident that it will be often practicable at sea to replace a broken part in this patent crank shaft of Mr. John Dickinson, than it would be to take out and fit a spare crank shaft of the ordinary type, a task usually impossible of accomplishment. By carrying a spare web and pin and two shafts, in the event of a break-down at sea the faulty part could easily be replaced by the engineers and their assistants on board, without the consequent expense, trouble and risk of taking the vessel into a port. The shaft exhibited by Mr. Dickinson is 20 ft. 6 in. overall length, 12 in. in diameter, and 3 ft. 6 in. stroke, and the webs of cast steel are by Messrs. John Spencer and Co., of Newburn.

The Tyne Forge Company, Limited, of Newcastle-on-Tyne, have a stand adjoining that of the last-mentioned. This Tyneside Company's exhibits are all of a high-class character, and will be found capable of bearing the closest inspection, being principally iron and steel crank shafts. Apparently it is becoming popular to dispense with ordinary couplings in crank shafts, and it would be interesting to know definitely where this idea first germinated. Here, on this stand, we find a portion of an iron crank shaft without collars, the connection of the lengths of shafting being formed in the webs. A forged steel crank-shaft for a land engine also attracted our attention, as well as a built crank shaft for a deadweight carrying steamer, being the spare crank shaft for one of the Bedouin Steam Navigation's fleet. This latter shaft is 10½ in. diameter, 3 ft. 3 in. stroke, and weighs three tons. We also noticed a steel crank shaft, 7½ in. diameter, for a small screw steamer, forged out of a Siemens-Martin steel ingot, and a forged steel bullet catcher.

The Palmer's Shipbuilding and Iron Company, Limited, exhibit a large number of half models of steam vessels recently built, of which our space only admits of a brief notice. The s.s. *Sportsman* is a three decked vessel with two decks of iron, of the following dimensions:—Length, 281 ft.; breadth, 36 ft. 2 in.; depth of hold, 23 ft.; and is classed 100 A1 at Lloyd's. The poop aft is fitted up with the officers' cabins, and on the bridge-house, which extends the length of the engine and boiler space, is the accommodation for the engineers; while the crew's quarters are in the topgallant forecastle. Water-ballast is fitted in the after-peak and below the after and main holds. The deadweight capacity of this vessel is over 3,100 tons—the gross register tonnage being 1,953 tons. The engines are compound, 200 N.H.P., with cylinders 33 in. and 64 in. diameter, 42 in. stroke. The s.s. *Huntsman* is similar to the s.s. *Sportsman*, but has one foot additional beam, and correspondingly increased tonnage. The s.s. *R. F. Matthews* is another three-decker, classed 100 A1 at Lloyd's, 270 ft. in length, 35 ft. 3 in. beam, 24 ft. 3 in. depth of hold, and the accommodation for the officers, engineers, and crew is very similar to the last mentioned vessels. Water-ballast tanks are fitted in the after hold, engine and boiler space, and fore hold. The upper deck is of wood, the main-deck of iron. The deadweight capacity is 2,665 tons, and the gross register 1,962 tons. Compound engines of 200 N.H.P. are fitted in this vessel, the cylinders being 32 in. and 62 in. in diameter, with 42 in. length of stroke. The s.s. *Glenrath* is a three-decked vessel, with a short quarter-deck for the officers' cabins, and has a short bridge-house at fore end of the engine and boiler space, the engineers' accommodation being in the deckhouse at the after end of the engine and boiler space. The crew's quarters are in the topgallant forecastle. The dimensions of the s.s. *Glenrath* are:—Length, 255 ft.; breadth, 34 ft. 6 in.; depth of hold, 23 ft. 6 in.; and the vessel is classed 100 A1 at Lloyd's. Water-ballast is fitted in the after hold and engine and boiler space, and there are two complete iron decks. The deadweight capacity is 2,535 tons, gross register tonnage 1,705 tons. The engines are of the ordinary compound type, with 30 in. and 60 in. diameter of cylinder, 39 in stroke, 160 N.H.P. The s.s. *North Durham* is a three-decked vessel, classed 100 A1 at Lloyd's, of the following dimensions:—Length, 265 ft. 5 in.; breadth, 35 ft. 3 in.; depth of hold, 23 ft. 2 in. A poop aft is fitted up for the captain and a few passengers. The officers' and engineers' accommodation is in the hurricane house over the engine and boiler space, and the sailors' and firemen's in the topgallant forecastle. The upper deck is of wood, the main deck of iron. Water ballast is fitted in the after peak and in the cellular bottom. The deadweight capacity is 2,570 tons, and the gross tonnage 1,890 tons. The engines are ordinary compound 180 N.H.P., with 33 in. and 62 in. cylinders, 39 in. length of stroke. The s.s. *North Cambria* is similar to the above in her general arrangements, excepting that the officers as well as the captain have their quarters in the poop. The dimensions of this vessel are as follows:—Length, 270 ft. 4 in.; breadth, 36 ft. 2 in.; depth of hold, 23 ft. 4 in. The gross register tonnage is 1,969 tons, the deadweight capacity 2,934 tons. The engines are compound, 200 N.H.P., the cylinders being 32 in. and 64 in. in diameter, 42 in. length of stroke. The s.s. *North Anglia* is a slightly larger vessel than the last mentioned, but similar in arrangements to the *North Durham*, excepting that instead of having a cellular bottom, ordinary water ballast tanks are fitted in the after hold, engine and boiler space and fore hold, and both peaks adapted for the same purpose. The dimensions are:—Length, 275 ft. 7 in.; breadth, 36 ft. 2 in.; depth of hold, 24 ft. 6 in. The gross tonnage is 2,081 tons, and the deadweight capacity 2,990 tons. The engines are ordinary compound of 33 in. and 64 in. diameter of cylinders, 42 in. length of stroke. The s.s. *Newminster* is a three-decked vessel, classed 100 A1 at Lloyd's, and is fitted with poop, hurricane house, and topgallant forecastle, water ballast in the after-peak and in the cellular bottom. The following are the leading dimensions:—Length, 262 ft. 8 in.; breadth, 35 ft. 2 in.; depth of hold, 22 ft. 6 in. The gross tonnage is 1,771 tons, and the vessel will carry 2,630 tons deadweight. The engines are compound, with 32 in. and 60 in. diameter of cylinders, 42 in. length of stroke. The s.s. *Briscoe* is a larger steamer than the *Newminster*, but similar in her construction and arrangements. The principal dimensions are:—Length, 292 ft. 5 in.; breadth, 38 ft. 3 in.; depth of hold, 23 ft. 7 in. The gross register tonnage is 2,292 tons, and the deadweight capacity 3,405 tons. The engines are of the ordinary compound type, 250 N.H.P., the cylinders being 36 in. and 68 in. diameter, 45 in. length of stroke. The s.s. *Bernicia* is a still larger vessel, similar in general design to the last-mentioned, and carries 3,808 tons deadweight. The dimensions are:—Length, 300 ft. 8 in.; breadth, 39 ft. 3 in.; depth of hold, 25 ft. 2 in. The gross register tonnage is 2,619 tons, and the vessel is fitted with powerful compound engines, the cylinders being 38 in. and 71 in. diameter, with 4 ft. stroke. The s.s. *Glendowe* is a three-decked vessel, 285 ft. in length, 37 ft. 2 in. beam, 24 ft. 4 in. depth of hold, classed 100 A1 at Lloyd's. A full poop is fitted up for the captain and officers, the engineers' accommodation is in the midship deckhouse, and the crew's quarters in the topgallant forecastle. The upper deck is of wood, the maindeck of iron, and water ballast is fitted in a double-bottom in the fore and after holds. The gross tonnage of this steamer is 2,200 tons, and the total deadweight capacity is 3,125 tons. Engines of the compound type are fitted of 260 N.H.P., having two cylinders, respectively 36 in. and 68 in. in diameter, with 3 ft. 9 in. length of stroke. The s.s. *Glenmavis* is similar to the last-mentioned steamer, but in place of the midship deckhouse the engineers are accommodated in a hurricane house, which extends the length of the engine and boiler spaces. The dimensions

of this steamer are:—Length, 286 ft. 4 in.; breadth, 37 ft. 2 in.; depth of hold, 23 ft. 1 in.; and the gross register tonnage is 2,114 tons. Instead of the ordinary ballast tanks the *Glenmavis* has a cellular bottom, but has also the after peak fitted for water ballast. Both the main and upper decks are of iron. This vessel carries 3,147 tons deadweight on an ordinary freeboard, and the engines also are identical in size and construction to those on the *Glendowe*. The s.s. *Glendevon* is a three-decked vessel, with full poop, hurricane house and topgallant forecastle, with ordinary ballast tanks in the after hold, engine and boiler space, and not so large as the vessels of the same line already described. The principal dimensions are:—Length, 260 ft. 8 in.; breadth, 35 ft. 3 in.; depth of hold, 23 ft. 3 in.; and the gross tonnage, 1,805 tons. The deadweight capacity is 2,590 tons. The engines are compound, 32 in. and 60 in. diameter of cylinders, 42 in. length of stroke, and of 190 N.H.P. The s.s. *Bretwalda* is an awning-decked vessel, classed 100 A1 at Lloyd's. The accommodation for the captain and officers are on the main deck right aft, the engineers' cabins are under the bridge, and the sailors and firemen have their quarters at the fore end of the main deck. The dimensions of this steamer are as follows:—Length, 320 ft.; breadth, 39 ft. 2 in.; depth of hold, 27 ft. 6 in. The main and awning decks are of iron, and the vessel has a cellular bottom; in addition water ballast is carried in the after peak. The deadweight capacity is 3,730 tons, the gross tonnage 2,907 tons. Compound engines of 300 N.H.P., with 38 in. and 71 in. diameter of cylinders, 48 in. stroke, are fitted in this steamer. The s.s. *Flamboro'* is a spar-decked vessel, and in our Special Supplement we illustrate this steamer's engines, which are fully described elsewhere. This vessel is classed 100 A1 at Lloyd's, and has a deckhouse aft for the captain and officers' rooms. The engineers' berths, &c., are on the main deck amidships, and the crew's accommodation is forward on the same deck. The bottom is constructed on the cellular system, and there is also water ballast in the after peak. The spar deck is of wood, and the main deck of iron. The dimensions of the s.s. *Flamboro'* are as follows:—Length, 265 ft.; breadth, 39 ft. 9 in.; depth of hold, 22 ft. 4 in. The gross register tonnage is 1,936 tons, and at Lloyd's freeboard the vessel has a deadweight capacity, including bunkers, of 2,900 tons. The s.s. *Era* is also a spar-decked vessel, and classed 100 A1 at Lloyd's. The principal dimensions are—Length, 271 ft.; breadth, 37 ft. 2 in.; depth of hold 22 ft. 6 in., and the gross tonnage is 1,851 tons. This vessel is a petroleum carrying steamer, being fitted specially for the oil-in-bulk trade. The engine and boiler compartments are in the after end of the hull, and next the boiler space is a cross bunker. Forward of the latter is a small water space, and then to within 15 ft. of the collision bulkhead there are six oil-tight compartments, on each side of the centre line longitudinal bulkhead, making in all twelve petroleum compartments. An additional water space is also fitted at the fore end of the forward oil tanks. In case the shipowners should decide to burn "Astaki" or other form of liquid fuel, the cross bunker is also divided by a centre longitudinal bulkhead. Complete arrangements are made for the expansion or contraction of the oil, filling tubes being led up to the spar deck from each of the twelve compartments. The pumping machinery, which is of special construction, is placed a few feet forward of the cross bunker bulkhead on the main deck. The main and spar deck of this steamer, and the hull generally, is of steel, and provision is made for water ballast in the fore and after peaks. The officers' cabins are on the main deck aft; the engineers' rooms at the sides of the after end of the engine casing on the same deck; and the crew's accommodation is forward. A monkey forecastle is fitted as an anchor deck. The engines of the s.s. *Era* are of the latest type—triple-expansion—180 N.H.P., the cylinders being in diameter as follows:—high, 21 in.; intermediate, 34 in.; and low pressure 56 in., with 3 ft. 3 in. length of stroke. The s.s. *Odiel* is one of the ordinary "well-deckers," having a long raised quarter deck, hurricane house, and topgallant forecastle, classed 100 A1 at Lloyd's, and of the following dimensions:—Length, 241 ft.; breadth, 33 ft. 2 in.; depth of hold, 16 ft. 6 in. The gross tonnage is 1,328 tons, and the vessel carries a large deadweight cargo. The hatches are of the self-trimming type, as patented by John Price, Esq., General Manager of Palmer's Shipbuilding and Iron Company, Limited. The raised quarter deck and the main deck are of iron, the officers' and engineers' rooms being on the latter deck amidships. Water ballast tanks are fitted on the double bottom system to the after and main holds, and the after peak is also available for the same purpose. The engines are compound 120 N.H.P., 28 in. and 54 in. diameter of cylinders, 3 ft. length of stroke. It will be remembered that the s.s. *Odiel* was one of the first steamers to have the boilers fitted with forced draught, on the "Ferrando" system. The s.s. *Linares* is a larger "well-decker," and thus somewhat similarly arranged to the last-mentioned vessel. The officers' rooms are on the sunk poop aft, the engineers' and crew as in the *Odiel*. This vessel's bottom is constructed on the cellular bottom principle, and in addition the after peak is available for water ballast. The dimensions of the *Linares* are as follows:—Length, 265 ft. 6 in.; breadth, 36 ft 3 in.; depth of hold, 17 ft., and the gross tonnage 1,646 tons. The hatches of this vessel are also self trimming, and the main and raised quarter decks of iron. The engines are compound, 140 N.H.P., with cylinders 32 in. and 60 in. diameter, 39 in. length of stroke. The s.s. *Linares* has a deadweight capacity of 2,309 tons. The s.s. *Mentana* is similar to the last described vessel, but of somewhat different dimensions, tonnage and deadweight, being 266 ft. 5 in. in length, 36 ft. 3 in. beam, 16 ft. 8 in. depth of hold, 1,664 tons gross register, and 2,268 tons deadweight. The s.s. *Palomares* is another "well-decker," and is classed 100 A1 at Lloyds. The principal dimensions are:—Length, 245 ft. 9 in.; breadth, 35 ft. 2 in., depth of hold 16 ft., and the gross tonnage 1,381 tons. The officers' and engineers' accommodation are under the bridge over the engine and boiler spaces. The deadweight carrying capacity is 1,935 tons. The engines are of the compound ordinary type, 30 in. and 57 in. diameter of cylinders, 39 in. length of stroke.

The s.s. *Prince Lewellyn* is also a well-decked vessel, and is fitted all fore and aft. with water Ballast on the McIntyre principle, and the fore and after peaks are also ballast compartments. The dimensions of the vessel are:—Length, 250 ft.; breadth, 36 ft. 2 in.; depth of hold 20 ft. The gross tonnage is 1,704 tons and deadweight capacity is 2,400 tons. The captain, steward, spare berth, &c., is on the lower deck aft, the officers' and engineers' accommodation is amidships, and the crews quarters in the forecastle. The engines are compound, of 160 N.H.P., the cylinders being 30 in. and 55 in. in diameter, 42 in. length of stroke.

The s.s. *Crown Prince* is a vessel classed 100 A1 at Lloyd's, having a raised quarter deck, hurricane house, and topgallant forecastle. The captain and officers' accommodation are at the fore end of the hurricance house, the engineers' at the after end, and the crew's quarters are in the top-gallant forecastle. The principal dimensions are:—Length, 258 ft. 3 in.; breadth, 36 ft. 2 in.; depth of hold, 17 ft. 3 in.; and the gross tonnage 1,655 ton. The main and quarter decks are of iron, the bottom of the vessel is constructed on the cellular system, and water ballast is also carried in the after peak tank. At an ordinary freeboard this steamer has a deadweight capacity of 2,255 tons. The engines are ordinary compound, of 152 N.H.P, having two cylinders 31 in. and 60 in. diameter, 39 in. length of stroke.

The s.s. *Glenlivet* is an ordinary well-decked type of vessel, constructed with a cellular bottom having also the after peak available for water ballast, and is classed 100 A1 at Lloyd's. The main and quarter decks are of iron, the officers and captain's rooms, &c., being aft, the engineers' berths at after end of hurricane house, and the crew's quarters in the topgallant forecastle. The principal dimensions are:—Length, 265 ft. 5 in.; breadth, 36 ft. 3 in.; depth of hold, 16 ft. 5 in. The gross register tonnage 1,610 tons; giving a dead weight capacity of 2,278 tons. The engines are ordinary compound, 160 N.H.P., 32 in. high and 60 in. low pressure cylinders, with 39 in. stroke.

The s.s. *W. J. Radcliffe* is of the well-decked type, but the forward so-called well is of a *minimum* length owing to the hurricane house being extended to the fore mast. The raised quarter deck, bridge and main deck are of iron, water ballast is arranged for in the after peak and double bottom, and the vessel is classed 100 A1 at Lloyd's. The captain and officers' accommodation is under the raised quarter deck right aft, the engineers berths and messroom, &c., at the after end of the hurricane house, and the crew's quarters in the topgallant forcastle. The principal dimensions of the *W. J. Radcliffe* are:—Length, 270 ft. 6 in.; breadth, 36 ft. 8 in.; depth of hold, 20 ft. 1 in.; and the gross tonnage 2 077 tons. On an ordinary freeboard the deadweight carrying capacity is 2,980 tons. The engines are of the latest type, triple-expansion, similar in general design to those of the s.s. *Flamboro*. The cylinders are of the following diameters:—High, 21 in.; intermediate, 34 in.; and low pressure, 57 in.; the length of stroke 3 ft., 3 in, and the N.H.P. 195. All the foregoing vessels represented by half models, twenty-four in number, were built and engined at Jarrow by the Palmer's Shipbuilding and Iron Company, Limited, and it is scarcely necessary to state that in each individual instance, it is evident that all the arrangements and designs have been carefully worked out, and that each of these vessels have proved highly creditable to this long established and deservedly respected Tyneside Company.

THE MARINE ENGINEERING EXHIBITS AT THE NEWCASTLE-ON-TYNE EXHIBITION.

THE Marine Engineering exhibits at the Newcastle-on-Tyne Exhibition far exceed in importance those exhibited last year at Liverpool. Had they not been scattered about the buildings this would have been more readily realized; but to the visitor bent on seeing the leading features of this exhibition, they will be found without much difficulty.

In our special supplement we illustrate, if not the most important, certainly, in one respect, the most interesting exhibit in this department, viz., the triple-expansion engines of the screw steamer *Flamboro'*. Our illustrations are reproductions of photographs taken off the actual engines, and, with the following description, will give our readers a full idea of the design and build of the triple-expansion engines, as usually fitted in mercantile steamers by the Palmer's Shipbuilding and Iron Company, Limited. . We have said in one respect the exhibit of the *Flamboro's* engines is the most interesting in the marine engineering department; and this is on account of there being a working model, with propeller attached. It is not, however, a toy model, but one-fourth of the actual size of the engines fitted on board the s.s. *Flamboro'*, the model as exhibited indicating about 20 H.P. Further, the model is interesting, as it has been constructed entirely by the workmen of the engineering department of Palmer's Shipbuilding and Iron Company, Limited. While those of our readers who have seen the engines under steam and at work in the West Court of the Exhibition will agree with the writer in expressing the opinion that the model is a splendid specimen of workmanship. The leading particulars of the *Flamboro's* engines are as follows:—The first, or high-pressure cylinder, is 22 in.; the second, or intermediate cylinder, is 35 in.; and the third, or low-pressure cylinder, is 58 in. in diameter; and the length of stroke 42 in. The cylinders are composed of hard, close-grained cast iron, smoothly bored, and fitted with escape valves, indicator cocks, and drain cocks, with handles to the starting platform. The high-pressure and intermediate cylinders are steam jacketed by means of a liner, and the three cylinders are neatly covered with felt and teak, secured by brass screws. As will be seen from our illustrations, the high and intermediate pressure cylinders have their valve chests in line with the cylinders, while in the case of the low-pressure cylinder the valve chest is in the front of the engines. Piston valves with loose liners are fitted to the high-pressure cylinder, and the low and intermediate cylinders have ordinary D-valves, double-ported in the former and single in the latter. A valve is fitted so as to admit steam to the steam chest of the second and third cylinders, with handle brought to the starting platform; and a relief valve is fitted to the same steam chests to prevent the possibility of high-pressure steam being let into the intermediate and low-pressure cylinders. The slide valves are all of hard cast iron. The high and intermediate pressure cylinders have Buckley's patent piston rings, and the low-pressure piston is fitted with ordinary cast iron packing rings. The junk rings are of cast iron, held down by wrought iron T-headed bolts and brass nuts so arranged that the bolts and nuts can be easily taken out without drawing the piston, the junk ring bolts having patent guards. The piston rods are of hammered iron, and are all duplicates of each other. They are secured to the pistons by nuts with solid forged heads, fitted with adjustable cast iron shoes for working on the guides. The recesses in the piston rod heads for the gudgeon brasses are flat-bottomed for convenience in lining up. The guides are bolted on the port-side columns, and are fitted with a very complete arrangement of oil-boxes and lubricators.

The connecting rods are two and a quarter times the length of the stroke of the engine, and are forged of the best scrap iron, having solid double eyes and gudgeons of large size at the top end, and fitted with flat brasses at the bottom end, the brasses being lined with white brass.

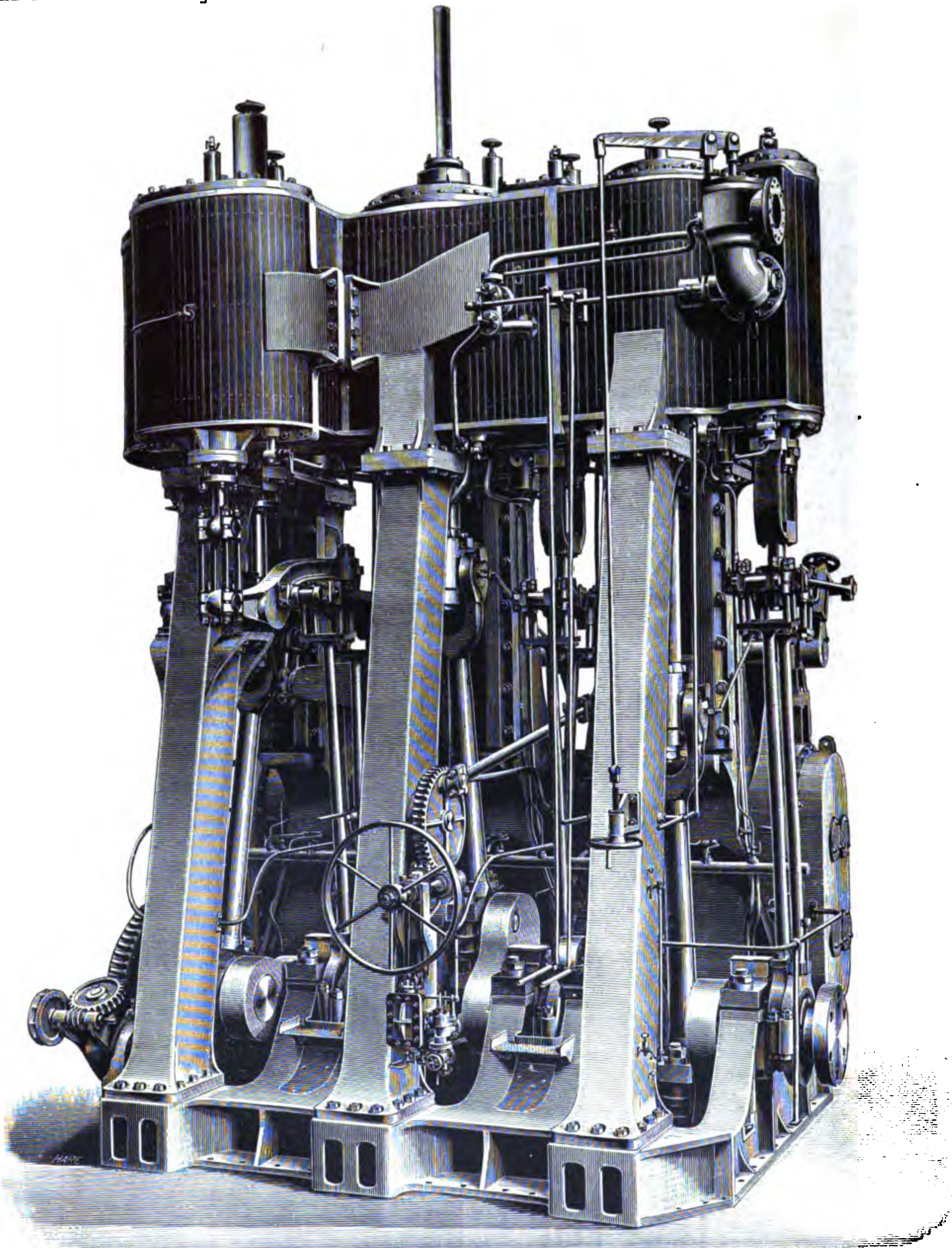
The crank shafts are $11\frac{1}{2}$ inches in diameter, set at angles of 120°, and are constructed in two pieces. The three double cranks are of iron, the pins of forged steel; and the two lengths of shafting are coupled in the centre crank, fitted with pin bolted to each part, each shaft being interchangeable.

The tunnel shafting is forged of the best hammered iron, having solid couplings forged upon each piece and properly jointed with turned bolts. The intermediate lengths are $10\frac{3}{4}$ in. diameter in the body, and 11 in. diameter in the bearings; and the propeller shaft is $11\frac{1}{2}$ in. diameter, lined up with brass in the wake of the *lignum vitæ* bush and stuffing box.

The stern tube is of cast iron, and efficiently secured to the stern frame of the vessel with a stuffing box on the inner end fitted with gun metal bushes, the after-end being fitted with *lignum vitæ* strips.

The screw-propeller is an ordinary four solid bladed one, 15 ft. 4 in. diameter, 17 ft. pitch, having a total made surface of 54·8 square feet.

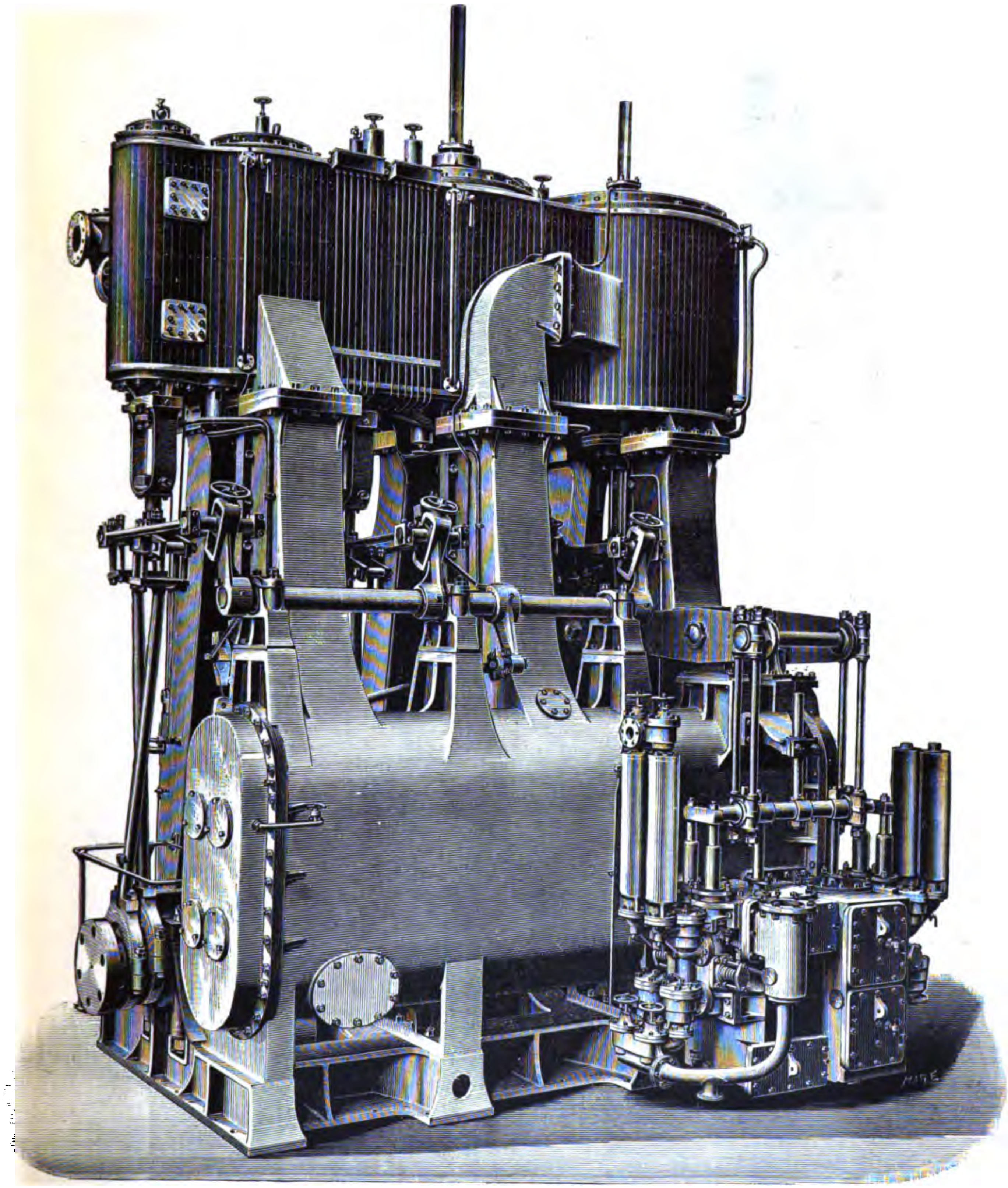
Returning to the engines, we notice provision is made wherever necessary for adjusting bearings in case of wear, the eccentric sheaves, which Palmer's Shipbuilding and Iron Company, Limited, usually make of cast iron with straps of solid gun-metal, or steel lined with gun-metal, having the studs for securing the eccentric rods to the straps left about three-quarters of an inch above the top nut to allow of the adjustment of the valves. It will also be noticed that the starting and reversing gear is conveniently arranged with regard to the working platform, which is on a level with the engine bed-plates. The air-pump is single-acting, of solid brass smoothly bored, fixed in a cast iron casing, and is of ample capacity; the bucket, foot, and delivery valve seats being of brass, fitted with metallic valves; and the pump rod is of the best forged iron, cased with brass. The circulating pump is double acting, of solid brass fixed in a cast iron casing, and arranged to force the water through the condenser, and to draw from either the sea or the bilges, with a pump rod similar in construction to that of the air pump rod. The bucket, foot, and delivering valve seats are all of brass with Indiarubber valves. The air and circulating pump levers are of forged iron fitted to a weigh shaft working in pillar blocks having adjustable brasses. The levers are worked off the after engine and fitted to the connecting rod gudgeon and pump crosshead by links having adjustable brasses. The feed pumps are of the best cast



TRIPLE-EXPANSION ENGI

CONSTRUCTED BY PALMER'S SH

For Desc



' THE S.S. "FLAMBORO'."

AND IRON COMPANY, LIMITED.

D 130.

iron, with brass rams worked from air and circulating pump crosshead, each pump being capable of being worked independently of the other, and each pump being of sufficient capacity so as to be capable of supplying the boiler, when the engines are going full speed. The suction and delivery valves are of brass, and the escape valves of brass with steel spiral springs. The bilge pumps are similar in construction to the feed pumps, and are likewise worked from the air and circulating pump crosshead, and are fitted with cast iron rams, brass suction and delivery valves and seats. As will be seen from our illustrations the bed-plate is designed so as to give ample strength and provide for it being most efficiently connected to the engine seating. Recesses having square bottoms are provided for the reception of the crank shaft brasses, the brasses being held down by wrought iron keeps and bolts and fitted with large syphon lubricators. The thrust bearing is of corrugated construction of ample surface on the horseshoe principle, with a bearing at each end, the thrust block being bolted to a strong wrought iron seat. As will be noticed the condenser is placed on the port side, with hollow cast iron standards cast on the condenser to support the cylinders on the port side, a duty performed by ordinary cast iron columns of ample strength on the starboard side. The surface condenser has a cooling surface of 1,500 square feet, the tubes being of brass ¾ in. external diameter, placed horizontally and packed with wood ferules in brass tube plates. All the joints between the cylinders, framing, condenser, air pumps and bed-plate are carefully faced and firmly secured, and a soda cock is fitted to the condenser.

The provision for the lubrication of the engines of the s.s. *Flamboro'* has been looked after to the fullest extent, as usual in engines constructed at the Jarrow Engineering Department of Palmer's Shipbuilding and Iron Company, Limited, syphon lubricators being attached to all the principal working parts of the engines, with pipes to carry the oil where required. Similarly an efficient water-service has been provided, connected to the circulating pumps. The steam pipes, and all pipes under pressure, are made of copper, with brass flanges of sufficient diameter for their respective requirements, the thickness of copper varying from No. 5 to No. 14 wire gauge. The bilge piping is partially of strong lead and cast iron. In the engine-room of the s.s. *Flamboro'* there are also the usual ballast, feed, &c., donkey pumps. A double-acting steam pump, with 8 in. diameter of cylinder and 8 in. length of stroke, and 3½ in. diameter of stroke, and 3½ in. diameter of pump, is arranged to pump from the hot well, the sea, and the bilges, and to deliver into the boiler, or overboard, or on deck. The water ballast pump is also double-acting, and arranged to pump from the water ballast tanks, the sea, and the bilges, and deliver into the sea, or overboard, or through the condenser; and is fitted with a reducing valve. Steam gauges as usual are supplied and fitted, including one steam and one vacuum gauge in the engine-room, and a compound gauge on the low pressure steam chest A governor, with all the necessary gear, is fitted up; also a telegraph between the engine-room and the captain's bridge and upper bridge, of the repeating type, with index plates, &c. The ladders and platforms are, as will be partially seen from our illustrations, conveniently arranged, comprising ladders from deck to starting platform. and to stokehole. The engine-room floor is laid with wood, and at the starting side is covered with thick lead, while the stokehole floor, as usual, is of cast iron plates. Strong lifting gear is provided, attached to a heavy wrought iron beam placed in the engine-hatch with all the necessary appliances for lifting and manipulating the cylinder and casing covers. Although we do not illustrate the boilers, the leading particulars of them may not be without interest. As well as the engines, the boilers were constructed by Palmer's Shipbuilding and Iron Company, Limited. They consist of two single-ended boilers, 13 ft. in diameter, 10 ft. 6 in. long, having each three furnaces of 3 ft. 2 in. diameter. The boilers are made entirely of Siemens-Martin steel, except the stays and tubes, which are of wrought iron. They were constructed in accordance with Lloyd's requirements for a working pressure of 150 lbs. per square inch, and were tested by water to 300 lbs. pressure per square inch. After being placed in the vessel and secured, they were coated with an effective non-conducting cement, secured with angle iron and broad iron bands. The funnel is provided with dampers and gear, an essential arrangement sometimes strangely omitted by other manufacturers of engines and boilers; and in other respects the funnel is fitted as usual with stay chains and air casing fitted with a cape above the deck. The boiler fittings, all of the most approved type, include the necessary steam, safety, feed, blow-off, and scum valves, gauges, furnace bars, &c. As to the merits of the general design and arrangements of the triple-expansion engines of the s.s. *Flamboro'*, our readers are in most instances as capable of forming a judgment as ourselves, with the assistance of the description we have been enabled to give them through the courtesy of Mr. J. P. Hall, the manager of the Engineering Department of Palmer's Shipbuilding and Iron Company, Limited. To our mind they have important characteristics, as, without indulging in any great departure from ordinary practice, comparative lightness has been combined with strength, and accessibility to all the working parts has been provided as far as possible to facilitate the every-day work of the Marine Engineer, or the ready carrying out of repairs at sea or in port.

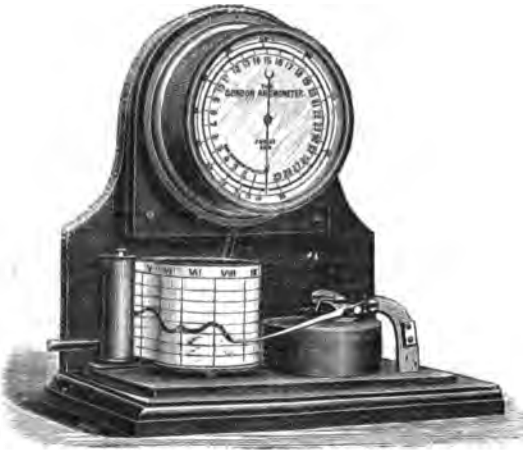
Besides exhibiting the working model of the *Flamboro's* engines at their stand in the West Court, there are a number of photographs of marine engines made by Palmer's Shipbuilding and Iron Company, Limited, for H.M. despatch vessels *Surprise* and *Alacrity*, H.M. belted cruisers *Orlando* and *Undaunted*, the s.s. *James Joicey*, and the s.s. *Flamboro'*, of which our special illustration is a reproduction.

GLASGOW INTERNATIONAL EXHIBITION.—The ceremony of cutting the first sod for the foundation of the Glasgow International Exhibition buildings was performed by Mr. James King, the Lord Provost. The site is in the Kelvingrove-park, on the plain immediately in front of the University at Gilmore-hill. The buildings, which will be erected from designs prepared by Messrs. Campbell, Douglas and Sellars, architects, of Glasgow, will cost about £30,000. They show a main building 680 ft. in length and 360 ft. in breadth, with an annexe for the machinery at one end, and there will be a transverse avenue across the whole breadth of the main building about half-way down. At the point of intersection the intention is to erect a dome 80 ft. in diameter, which will rise to a height of 110 ft. The Queen, Prince and Princess Christian, the Duke and Duchess of Edinburgh, the Duchess of Albany, and the Duke of Cambridge have been pleased to extend their patronage to the institution. The guarantee fund is over £200,000

THE "GORDON" RECORDING ANEMOMETER AND PRESSURE GAUGE.

WE have examined with much interest an instrument so-called, which ought to commend itself to all seafaring men. Its simplicity seems only second to its usefulness, if the explanations given to us are correct, and we see no reason to doubt them.

The object the inventor has in view is to give timeous notice of rapid changes in the wind, and as an eminent commander, who has one in constant use, expresses himself, "only consider what an advantage it is to be able to tell your officer, when the instrument marks four,



take in the royals, and when six, take in the topgallant sails, instead of waiting until something is carried away."

The instrument, as will be seen by the illustration, has a clock-faced dial, on which is indicated, in Baufort notation, force of wind velocity in miles per hour and pressure in pounds per foot, thereby enabling the captain by a glance to see the exact pressure, and so sensitively does it act—even with the instrument in the cabin and the point of exposure 100 yards off—that from the slightest breeze to a gale of the greatest force it is correctly indicated, besides recording every variation, with time of occurrence, which record can be preserved for inspection.

One of our coasting captains, after trial, sees much utility and greater safety to vessels in fogs, and during the night, where a strong wind is apt to drive them out of their course, however careful commanders may be to avoid divergencies by making allowances; but without some such certain indicator as this it is not an easy matter, and always attended with much anxiety. This instrument, giving as it does the exact pressure, meets the difficulty.

Mr. Gordon has already shown the instrument to the best authorities, who have expressed the greatest satisfaction, resulting in orders for foreign-going ships, coasters, yachts, and observatories, and we should strongly recommend all interested to make a personal inspection, by calling on Mr. Gordon, at Winchester House, Old Broad Street, E.C.

FAST STEAMING BY CLYDE-BUILT VESSELS.

MUCH of the shipbuilding and engineering work which has recently been turned out exhibits the high qualities of which Clyde workmanship has long been famous. In support of this we might instance several cases of hugh steamships notable for strength of structure and power of engines, *e.g.*, the magnificent P. & O. line, the *Victoria*, of 6,600 tons, built by Messrs. Caird and Co., and the belted cruiser for H.M. Government, the *Australia*, built by Messrs. Napier & Sons, but there is more call to point to the number of "fastest passages on record" which different types of vessels of recent Clyde build have been achieving. Notable amongst these are the performances of the *Queen Victoria*, and the *Prince of Wales*, the new paddle steamer on the Liverpool and Isle of Man service. On the trial trip of the latter vessel the speed attained was 24½ knots, or 28 miles per hour, and on a steaming distance of 32 knots between Ailsa Craig and Cambric Light, which was accomplished in 1 hour 25 minutes, the average speed was 22·6 knots or 26 miles an hour. The *Prince of Wales* is therefore entitled to be considered the fastest steamer in the world (exclusive of some recent torpedo boats), and only slightly better than her sister ship, *Queen Victoria*, which covered the distance between Tail-of-the-bank, Greenock, and Liverpool in 9 hours 23 minutes, steaming time, the mean speed being 22½ knots per hour. The race for supremacy in this important service has seemingly not yet been completed with the placing of these two craft on the route, as it is stated that the Isle of Man Steam Packet Company have asked the Barrow Shipbuilding Company if they can guarantee to produce a steamer to go at least 25 knots or the matter of 30 miles per hour. The reply to this, it is understood, has been made in the affirmative, and it will probably lead to an order. This of course means additional and still faster vessels of Clyde build in the future. The new steamer, *Meteor*, built by Messrs. J. & G. Thomson for the London and Edinburgh Shipping Company has accomplished the voyage between London and Leith—wharf to wharf—in 27 hours and 45 minutes, and from Gravesend in 25 hours 40 minutes, this being the fastest passage on record between the two places, a distance of 475 nautical miles. Of this steamer it is interesting to note that although exactly of the same form and dimensions as the *Iona*, the last crack vessel built for the company, she is about 5 per cent. lighter in structure owing to improvements in systems of construction. She is fitted with the now universal triple-compound engines, and the substitution of these for the ordinary double-compound type results in the engines developing 50 per cent. more power with an addition in the weight of engines of only 16 per cent. over the old system. The *Iona*, it may be added, which left London 1 hour and 50 minutes before the *Meteor* on the passage above alluded to, only reached Leith 5 minutes sooner than the latter vessel.

Another circumstance in which Clyde people justly take pride is the recent "breaking of the Atlantic record" by the Cunarder *Umbria*. This noble vessel recently made the run from Queenstown to Fire Island, New York, in 6 days, 2 hours, 37 minutes, the shortest time on record. The best passage previously made was accomplished by her sister ship the *Etruria* in 6 days, 5 hours, 31 minutes, to Sandy Hook, the latter being 35 miles, or equivalent to 1¾ hours further steaming than Fire Island.

THE MESSAGERIES MARITIMES.—The Council of Administration of the Messageries Maritimes has announced a dividend of 6 per cent. per annum for 1886. The corresponding dividend for 1885 was at the rate of 5 per cent. per annum.

H.M.S. UNDAUNTED.—Messrs. Chadburn & Co. have supplied to H.M.S. *Undaunted* their engine telegraphs, bridge and conning tower to port and starboard engines; also telegraph communication between engine-rooms and stokeholds; Chadburn's latest patent speed and direction tell-tale dials fitted on deck, whereby the commander can see at a glance the direction and number of revolutions of the engine shafts; also steering telegraph from bridge and conning tower to each of the steam-steering and hand-steering positions; indicating tell-tale showing the degree of angle of the rudder.

THE ISLE OF MAN STEAMER "QUEEN VICTORIA."

ON May 26th the shareholders in the Manx line of steamers were invited to a trial trip of the new steamer *Queen Victoria*, which had arrived in the Mersey from the builders at Govan. The new steamer passed the Victoria Tower at 10·15 a.m., the Rock Light at 10·22, Crosby Lightship at 10·40, and Formby Lightship at 10·50, where she stopped a little, then proceeding, she reached Douglas at 1·57 p.m. A large number availed themselves of the opportunity for a day's outing to the Isle of Man and back, and the performance of the steamer was watched with very keen interest. It is claimed, in the first place, that she is the fastest vessel afloat, and besides this claim for public favour she possesses very complete accommodation for passengers. Not only in Liverpool, but over a wide district of Lancashire, the doings of the *Queen Victoria* are regarded with interest, for the present season has witnessed a remarkable development in communication with the Isle of Man from the Mersey. The new steamer has been built by the Fairfield Shipbuilding and Engineering Co. (Limited), of Govan, of which Mr. John Pearce is the well-known head; and certainly no efforts or pains have been spared to substantiate her claim to be the fastest as well as most luxurious vessel afloat. On her way from the Clyde to the Mersey she is said to have attained a speed of 25 miles an hour. With 1,400 passengers on board, and the water being exceedingly smooth, she made the passage from Liverpool to Douglas in 3 hours and 35 minutes, the distance being, roughly, 80 miles. This rapid passage was accomplished, too, despite several slowings on account of the "priming" or heating of the bearings of the engines, a contingency often encountered in the early performances of new steamers. After a short stay at Douglas, the steamer started for Ramsey about 3 o'clock, whence, after allowing the passengers an opportunity of landing, she sailed for Liverpool at 5·14, and at 5·19 proceeded at full speed, passing Maughold Head at 5·27; afterwards slowing, she came under easy steam, crossing the bar at 8·35, and arriving at the Liverpool landing stage at 9·20. On this occasion the engines were not pressed much, for though once or twice it was stated that the steamer was then travelling at the rate of 22 knots an hour, the passage occupied four hours. The *Queen Victoria* is to be noted for a remarkable promenade deck, extending the whole length and breadth of the vessel; and the workmanship in all departments is admirable. Life-saving rafts, cushions, and life-buoys and boats are liberally supplied. The *Queen Victoria* is 330 ft. long, has 40 ft. of beam, and her gross tonnage is 1,500. She is commanded by Captain Lewis. The trip was in all essentials a pleasant one, the weather being fine if dull. At the luncheon Captain Price, of the Guion Line, presided, and read a number of letters and telegrams, including one from Her Majesty, wishing success to the *Queen Victoria*. The general traffic agent, Mr. Henry K. Aspinall, was on board, and was congratulated on the successful performance of the steamer. The majority of the passengers, after leaving Liverpool late at night, had to take trains for their destinations in various parts of Lancashire. The band of the *Indefatigable* was on board and rendered very efficient entertainment, both vocal and instrumental. We have already given a full description of this splendid vessel, but would add to what we have stated that the furnaces of the boilers are fitted with the Venetian air valve furnace bars, Galley's patent.

THE AMERICAN CRUISER "ATLANTA."

THIS new single-screw cruiser, constructed for the American navy by the late John Roach, has passed through her steam trials, and now lies at the Brooklyn Navy Yard ready for service. She is a sister ship of the *Boston*, which vessel, as well as the twin-screw cruiser *Chicago* and the despatch boat *Dolphin*, is finished as regards her machinery and hulls, but has not yet received her armament. The principal dimensions of the *Atlanta* are as follows:—Length between perpendiculars, 270 ft.; length on water line, 276 ft.; length over all, 283; extreme breadth, 42 ft.; mean draught at load water line, 16 ft. 10 in.; displacement at water line, 3,000 tons; sail area, 10,400 square feet; I.H.P., 3,500; speed at sea, 13 knots; capacity of coal bunkers, 580 tons. The vessel is built of steel, and is divided into nine main compartments by eight complete transverse bulkheads extending to the main deck. The boilers and machinery are protected by a coal armour 8 ft. thick above the water line and 5 ft. below it, the coal bunkers being formed by longitudinal bulkheads extending on each side through the machinery space. The doors closing the compartments can be worked from below or from the main deck. In addition to the 580 tons of coal carried in the bunkers, about 200 tons more can be taken on board if necessary; and thus filled with coal the *Atlanta* would be able to steam 2,500 miles at full speed, or 5,300 miles at the rate of 10 knots. For a length of 100 feet the machinery spaces are protected by a steel deck 1½ in. thick, and at the bottom of these spaces is a water-tight double bottom divided into 12 water-tight cells. The outside plating is 23 lbs. to the square foot, and is doubled from the stem to near the stern at the water-line. The machinery consists of a three cylinder compound horizontal engine of 3,500 H.P.; the high-pressure cylinder being 54 in. and the two low-pressure 74 in. in diameter, the latter being arranged on either side of the former, and the length of stroke is 42 in. The steel shaft is 16 in. in diameter at the journals, and is made in three interchangeable sections. The low pressure cranks are set at right angles, while the other is placed between the two at an angle of 135 deg. The screw is four-bladed, 17 ft. in diameter, and has a pitch of 20 ft. Steam is supplied by eight horizontal return tubular boilers, placed forward of the engine, and separated into two groups by a transverse bulkhead. Each boiler is 9 ft. 9 in. long and 11 ft. 8 in. in diameter, and is provided with two cylindrical furnaces having grate surface of 25 square feet. A forced draught is obtained from six blowers, each having a capacity of 12,000 cubic feet per minute. The boilers were tested to 160 lbs. The *Atlanta* has made three trial trips, the last of which was from the Navy-yard out to sea and return, running continuously from seven in the morning to seven in the evening. The average speed obtained was 15·35 knots for six hours, the maximum being 16·33 knots. The maximum I.H.P. was 3·506. The boiler pressure varied from 94 lbs. to 96 lbs., the safety valve having been set to blow off at 100 lbs. The shaft made an average of 68 revolutions per minute. The engines were not stopped during the whole of the trip, and everything is stated to have worked easily and satisfactorily, and her speed was far above that contracted for. The guns of the *Atlanta* are to be tested shortly. Her armament consists of two 8-in breech-loading rifled guns, one being placed on the forward deck and one a stern chaser; six broadside 6-in rifled guns, seven Gatling guns, and one 3 lb. 47-millimètre Hotchkiss gun, the latter being placed in a Hotchkiss tower. The vessel is also provided with two search lights and an armoured pilot-house.

LIVERPOOL ENGINEERING SOCIETY.

AT a recent meeting of this Society a paper was read by Mr. J. F. Waddington on "Submarine Vessels." In commencing the paper the author gave a brief history of what had been done in submarine navigation. Few persons, he said, would be aware that the idea of a vessel to travel under water was anything but a new idea. There were records of submarine vessels as far back as 1648, and a very interesting series of experiments were made by Fulton in 1801. Submarine vessels, he stated, were used in the American Civil War, and numbers of patents had been taken out in America, none of which, however, had come to anything. He then referred to the submarine vessel the *Resurgam*, designed by Mr. Garratt, and tried in the Birkenhead Float in 1879, and also the Nordenfelt boats, which were also from Mr. Garratt's designs. His own submarine vessel, the *Porpoise*, which was tried last year before the representatives of the British and foreign Admiralties was then described. She was, he said, 37 ft. long by 6ft. 6in. beam, and was arranged to be propelled by electricity. The *Porpoise* was submerged when under way by means of inclined planes, which, when the buoyancy of the vessel had been sufficiently reduced by taking in water, were set over at an angle, and so guide the vessel below the surface. He also described the horizontal propellers working in the vertical tubes used in his boats for the purpose of driving below in cases of emergency when there was no way on the boat. The great danger with submarine vessels of suddenly diving by the head when going at any speed was then dealt with, and he showed how, by means of a horizontal rudder arrangement, actuated by an automatic electric steering gear, he had met this danger. Compressed air for consumption by the crew was, he

[illegible] carried in two compartments at the ends. For the [illegible] of the vessel and for driving the various machinery on board the vessel the electricity was stored in 45 accumulators of [illegible] ampère hours capacity. The maximum current taken by the motor was [illegible] ampères, the electric motive force being 90 volts, thus giving an electrical H.P. of 7·96; with a motor of [illegible] per cent. efficiently the actual H.P. would be 6·77. The author stated the speed of the boat with this power would be about eight miles per hour, at which speed she would be able to run a distance of 80 miles.

THE NEW LONDON AND LEITH STEAMER "METEOR."

THE screw steamer *Meteor* built by Messrs. James and George Thomson, Clydebank, for the London and Edinburgh Shipping Company's passenger service between Leith and London went down the Firth of Clyde on the 6th June on her trial cruise. A large company of gentlemen went with the vessel, the majority having travelled by rail from Glasgow and Edinburgh and joined the steamer at the Tail of the Bank. When passing the measured mile at Skelmorlie the vessel was timed, and though laden beyond her ordinary sailing draught, and much beyond the usual trial trip-draught, she attained a speed equal to 15¼ knots per hour.

The *Meteor* is the sixth vessel built by J. & G. Thomson, for the London and Edinburgh Shipping Company. She is 260 ft. long, 32 ft. broad, 19½ ft. deep, with a gross tonnage of 1,220 tons. In form she is a duplicate of the *Iona* the last vessel built for the same company, but the internal arrangements have been considerably improved upon. The engines are of the triple-expansion type, the high pressure cylinder being 29 in. diameter, the intermediate 44 in., and the low pressure 70 in., with a stroke of 48 in. Steam is supplied from two steel boilers, having in all 12 corrugated furnaces. Accommodation for about 100 passengers is provided in the afterpart of the ship, the saloon and state rooms being fitted up and furnished in a luxurious manner. Comfortable berths have been provided in the forepart for about 50 second-class passengers. The vessel is lighted by electricity, and is fitted with all improved appliances for the rapid and economical working of ship and cargo.

On the downward run, luncheon was served in the saloon. Mr. James R. Thomson presided and Mr. Thomas Aitken, managing director of the shipping Company, occupied the croupier's chair. In the course of the proceedings, the chairman proposed "Success to the Ship" and in doing so he remarked that the *Meteor* was in many respects an improvement on the vessels previously built for the same Company. She had triple-expansion engines, being the first of the Company's ships fitted with this type, and he fancied that in the future compound engines would be unknown to the Company. The advantages to be gained by the adoption of the new type were very evident. Although exactly of the same dimensions and form as the *Iona* the last vessel built for the company, the *Meteor* owing to improvements in the system of construction was about 5 per cent. lighter in structure. The substitution of triple-expansion for compound engines resulted in the engines developing 50 per cent. more power, and the weight entailed by that was only something like 16 per cent. more. They were therefore justified in saying, that when the *Meteor* got on her passage she would at least equal any vessel on the route, and he had hopes she would even outstrip them.

The vessel for many reasons will be serviceable in times of war for patrolling the sea. She can steam 15¼ knots at sea continually, and as she is only 260 feet long, considerably shorter than the mail steamers which usually attain that speed, she would make a better cruiser than these large mail steamers, because she is a handier ship to manœuvre in presence of the enemy. She is divided into nine main compartments, and a door is only placed in the bulkhead dividing the boilers from the engines, and that door can either be closed from the upper deck or from the engine room below in a few seconds.

THE UNITED STATES NAVY.—A Bill has been introduced into the senate of the United States by Mr. Butler, of South Carolina, for the construction of a steel cruiser, which is to have a sea speed of not less than 20 knots per hour during moderate weather. The Bill appropriates 2,500,000 dols. to cover the cost of the cruiser.

H.M.S. "IMMORTALITÉ."

ON June 7th H.M.S. *Immortalité* was floated out of the Government Dockyard, Chatham, where she has been built. The *Immortalité* is a twin-screw fast belted cruiser, built of steel. She was commenced on the 18th of January, 1886, and is one of seven ships of the belted cruiser class ordered by the Government—two to be built at Jarrow, two at Glasgow, and one each at Pembroke, Hull, and Chatham. The length of the vessel between the perpendiculars is 300ft.; her extreme breadth is 56 ft.; she has a draught of water of 19 ft. 6 in. forward and of 22 ft. 6 in. aft.; and her load displacement in tons is 5,000. The armament of the *Immortalité*, when completed, will consist of two breech-loading guns of 22 tons and 9·2 in. bore, and ten of five tons and 6 in. bore; 16 quick-firing guns, six of them six-pounders and ten three-pounders; four R. M. L. guns, three of them nine-pounders and one seven-pounder; and five Nordenfeldt guns, one two barrelled and of 1 in. bore, and four five barrelled and of ·45 in. bore. The vessel will also carry 20 Whitehead torpedoes. She has steel-faced armour to the depth of 10 in. on the belt and a thickness of 16 in. of iron on the ends of the belt. The protective belt has plating 2 in. thick on the horizontal surface and 3 in. thick on the inclined surfaces at the sides. The engines are to be of horizontal triple-expansion pattern, with an I.H.P. of 8,500. The speed of the vessel is 18 knots, and the coal bunkers have a total capacity of about 900 tons. The crew is to consist of 421 officers and men. The estimated cost of the hull, including dockyard expenditure on machinery, masts, yards, and rigging, is £200,310, and the contract price of the engines is £55,910. A large number of persons assembled in the dockyard to see the floating of the vessel. The workmen were granted leave to see the ceremony and for the remainder of the day, while the general public were admitted to the dockyard on either side of the No. 2 Dock, where the *Immortalité* lay. Within the No. 2 Dock space was reserved for the officials and special guests, among whom were Admiral W. Graham, C.B., Controller of the Navy; Admiral Codrington, C.B., Admiral Superintendent of the Yard; Mr. W. H. White, Director of Naval Construction; Captain Lord Charles Scott, Lord Darnley, and Mr. J. A. Yates, Constructor of the Yard. The ceremony was held at one o'clock, the Rev. W. Law, naval chaplain, reading the service used at the launching of Her Majesty's ships. Mrs. Graham, wife of Admiral Graham, then formally christened the vessel, and, by touching a small bell, released the chain holding the bows, and the *Immortalité* was towed out of dock amid the cheers of those assembled, and floated down stream to the basin, where she is to be fitted out.

SOUTHAMPTON DEEP WATER DOCK.

GOOD progress is being made with the works in connection with this dock, for which Mr. A. Giles, M.P., is the engineer. The sea bank, necessary to reclaim an area of about 40 acres of mud flats, has been closed, and the contractors, Messrs. S. Pearson and Son, of Westminster, are now able to proceed with the work of the dock proper, the site of which was formerly under water. Plant to a very considerable extent has been placed on the ground, and employment will be found for many hundreds of labourers and others. It is contemplated having the whole of the works completed in about 18 months, a very short time for works of such magnitude. Night work will be required and used to a large extent, and artificial light employed for illuminating purposes.

The dock, of which the water area is to be 18 acres, will be an open dock—*i.e.*, tidal—and will have a depth at low water ordinary spring tides of 26 ft. Nearly 4,000 ft. of concrete wall has to be erected 51 ft. 6 in. high from the foundations, which are to be at a depth of 6 ft. 6 in. below the dock bottom.

The approaches to the dock will be dredged to the same level as the dock, so as to give every facility to the largest vessels afloat for arrival and departure at any state of the tide.

The future of Southampton is undoubtedly secure, and works such as this new deep water dock cannot but tend to increase not only its mercantile trade, but also its general prosperity as a business place.

The dock company is to be congratulated on its efforts to provide these additional facilities for the benefit of the public in general, and the mercantile navy of the Empire in particular.

LAUNCH AT KOWLOON DOCKS.

A NEW steamer built by the Hongkong and Whampoa Dock Company, Limited, to the order of Messrs. Marty and D'Abbadie, for the *Service des Correspondances Fluviales au Tonkin*, was successfully launched at Kowloon Docks on April 29th. This vessel is the first of three contracted for by the Dock Company—the remaining two being now in hand, and sufficiently far advanced to justify the belief that they will be ready for delivery well within the contract time—which have been specially designed for the shallow waters of the Tonkin canals and Red River, and for which purpose there can be no doubt they will be found admirably adapted. The principal dimensions of the vessel are:—Length over all, 120 ft.; length between perpendiculars, 116 ft.; beam, 24 ft.; depth of hold, 8 ft.; height from main to spar-deck, 7 ft.; height of saloon, 7 ft.; carrying 100 tons of cargo on 5 ft. draft.

She is built of mild steel throughout, and has four water-tight bulkheads. The accommodation for Europeans, which is spacious and substantially fitted up, is on the spar-deck, and consists of captain's room on the forepart, the mail room immediately behind the steering gear, and abaft these is the first-class saloon, with accommodation for 24 persons. The saloon is similar in appearance to those of the Canton river steamers. To provide extra sleeping accommodation for male passengers, the backs of the settees in the saloon are made to hinge up and form open berths; when in the ordinary position this arrangement is imperceptible. Abaft the saloon, and opening from the centre passage, are two ladies' state-rooms, fitted in a suitable manner for the climate, and farther aft are two more ladies' cabins. The sides of the saloons and cabins are fitted with large sliding glass windows and venetians, and a raised skylight passes along the centre and passage way, giving a light and airy appearance to the interior. The saloon will be painted in white and gold. A passage way all round the saloons, cabins, &c., on the spar deck, will be found convenient. Next to the state-rooms, with a passage between, are the pantry and bath-rooms, and alongside of the engines and boiler-room casings are the engineers' and officers' cabins, with lavatories, &c. Abaft these cabins are stairs leading on to the main-deck and the second cabin, principally intended for the accommodation of native female passengers. This is a large cabin, and behind it are two rooms for the purser and compradore. On the maindeck forward the bulwarks are carried up to the awning deck, and the crew will be berthed there. On this deck are the necessary ice rooms, lamp room, native cook house, water closets, &c.

There are two main hatches, the forward one to have a steam winch and a crane on either side, and a steam capstan and windlass forward. A fresh water condenser of about 1,200 gallons capacity per day will be fitted on the spar deck, having the necessary connections to boiler and donkey pump.

The engines are inverted compound direct acting for twin-screws, and are entirely separate from each other. The cylinders are 12 in. and 24 in. diameter, having a stroke of 15 in. indicating about 320 H.P. The boiler is of mild steel, built to Board of Trade Rules for 100 lbs. pressure per square inch, and is 9 ft. 9 in. diameter and 10 ft. long, having two of Fox's patent corrugated furnaces of 3 ft. mean diameter. It speaks well for the capabilities of the Dock Company that the construction of this boiler, from the time the plates arrived until the water test pressure was applied, occupied only two months. There is also a Cochrane's patent donkey boiler, which is on the starboard side of the stoke-hole. In addition to the usual fittings there is a liberal supply of spare gear.

By the invitation of Mr. R. Cooke, the assistant manager of the Dock Company, a number of gentlemen were present at the launch, amongst others M. Rigoreau, acting consul for France, and several French gentlemen interested in Tonkin. Everything being in readiness the shores were knocked out, allowing the vessel to glide gracefully along the launching ways into the water, Mrs. W. C. Jack, wife of the superintending engineer of Messrs. Marty and D'Abbadie's steamers, performing the christening ceremony in the orthodox manner, and the Chinese workmen invoking good luck from "Joss" with a shower of fire-crackers. The vessel has been named the *Con-rong*, which is Annamese for dragon. Her engines were on board when launched, and we observed that she was drawing 3 ft. 6 in. of water aft and 2 ft. 3 in. forward. Immediately after the launch the *Con-rong* was hauled alongside the shear-legs and the boiler put in place, so that in a very short time she will be completed and ready for sea. The vessel has a substantial appearance in the water, and will no doubt be found suitable in every respect for the traffic between Haiphong and Hanoi. The contract speed is 10 knots per hour, but it is expected that this will be considerably exceeded.

Miscellaneous.

Tasmanian Shipbuilding.—The first iron ship ever built in Tasmania has been launched from the yards of Messrs. Kennedy and Son, Battery Point, Hobart Street. It is a large dredge, intended to be used in deepening the Mersey.

The Suez Canal.—The report read at the annual general meeting of the shareholders of the Suez Canal, held at Paris on June 8, shows the receipts for the past year to have been 5,300,000 fr. less than in 1885, and proposes the declaration of a dividend of 75 fr. 33c.

Australia.—The new belted cruiser *Australia*, 12 guns, 5,000 tons, 8,500 H.P., arrived at Sheerness on June 6th from Glasgow, where she has been built for the Royal Navy by Messrs. Napier & Sons. The *Australia*, was transferred to the charge of the Medway Steam Reserve authorities, and is to be immediately completed for sea at Chatham Dockyard.

Roper's Life-Saving Raft Boats.—At Palace Chambers, Bridge-Street, Westminister, there are daily exhibitions of Roper's raft boats, from noon till six o'clock. There are a large number of models, and the capabilities of this valuable invention are fully illustrated. The committee appointed by the Board of Trade to consider life saving apparatus recommend Roper's bridge raft as the best in their report presented to Parliament May, 1887.

Shafts for American Cruisers.—The Union Iron Works of San Francisco, which are building the cruiser *Charleston*, have ordered the shaft for that ship from Krupp, of Essen. Messrs. Cramp will obtain the shafts for the three vessels which they are to build from an English house, that of Whitworth.

Fast Passages.—The agent of the Cunard Line at Queenstown received a submarine telegram on Saturday, June 11th announcing that the *Umbria*, which left Queenstown at 1 p.m. June 5th had arrived in New York, making the voyage in six days, three hours, the fastest time yet recorded. The Orient Line Royal Mail steamer *Oroya* arrived in Plymouth Sound at 6 a.m. on Saturday. Her dates are:—Sydney, April 23rd; Melbourne, 30th; Adelaide, May 2nd; Aden, 20th; Suez, 24th; and Port Said, 25th. Length of Passage from Adelaide to Plymouth, 32 days, 10½ hours, which is the fastest on record. She would have arrived 12 hours earlier, but was detained by a dense fog in the Channel. She brought 1,450 carcases of mutton.

Obituary.

MR. JOHN FERGUSSON, SHIPBUILDER.

Mr. John Fergusson, who was a partner in the shipbuilding and enginering firm of Messrs. Barclay, Curle & Co., and an ex-provost of Partick, died at his residence, Larkfield, Partick, on the evening of the 11th ult. Some days previous to his decease he had been operated upon for a small tumor in the fore-head with apparent success, but in the course of a day or two erysipelas set in on the side of the head and neck, ultimately attacking the kidney and surrounding organs, and ending in death, as stated. Mr. Fergusson was born in Greenock in 1833, and was trained as a shipwright. About 40 years ago he entered the service of Messrs. Barclay, Curle & Co., and in course of time became manager to the firm. Soon after his promotion he was further honoured by being assumed a partner in the firm, which about that time removed their shipbuilding works to the larger and more commodious premises they still occupy at Whiteinch. Mr. Fergusson managed the yard practically till the date of his death, but latterly he took a less active part. He filled the important and honourable office of provost of Partick during 1875-6-7 with great acceptance, and all along took an active share in the management of municipal affairs. He manifested a warm and practical sympathy in the welfare of the people of Partick—socially and intellectually—and contributed freely to charitable objects. He was married to a Greenock lady, and had five daughters and four sons, the eldest being Mr. John Fergusson, of Messrs. Ramage & Fergusson, shipbuilders, Leith.

INDUSTRIAL NOTES.

THE CLYDE, AND EAST AND WEST SCOTLAND.

SINCE the announcement regarding the contract made by Messrs. Thomson, of Clyde Bank, for the construction of the second of two large Inman Line steamships, rumours, at that time current, regarding new work, have in some cases been justified by the actual placing of orders, while in others they have been shown to be either premature or without foundation. Many of the best firms on the river have one or two vessels on the stocks. This is the case with the London and Glasgow Shipbuilding Company, Messrs. D. & W. Henderson and A. & J. Inglis, Partick, Messrs. Caird & Co., Greenock, Messrs. Denny Brothers, and Messrs. McMillan & Son, Dumbarton. The Greenock Foundry Company have secured an order for two sets of twin screw engines of 2,000 H.P. each, for the new gunboats *Daphne* and *Nymph*, being built for the British Government in Portsmouth and Sheerness Dockyards. The saving effected by adopting the triple-compound type as compared with the ordinary double-compound type of engine is now seen to be so certain and considerable that many owners are converting the old into the new type, or entirely replacing the latter for the former. A case of this kind has recently been completed in the *Anchoria* of the Anchor Line, with satisfactory results in the matter of lessened consumption of coal. The engineers effecting the change were, Messrs. D. & W. Henderson, Partick. It is believed that others of the Anchor Line fleet will be similarly treated as opportunity offers. Of other orders recently received, reference may be made to that secured by Messrs. Rankin and Blackmore, Greenock, for the construction of a large elliptical return-tribular boiler and fittings, also a propellor with shafting and other sundries, for the Government of Mauritius, and to the order secured by the Grangemouth Dockyard Company, for a steel-screw awning-decked steamer of about 600 tons, for a Spanish firm, the machinery for which will be supplied by Messrs. Hutson & Corbett, of Kilvinhaugh Engine Works. On the morning of 31st May, the *Australia*, the first of the two belted cruisers which Messrs. Napier are building for the British Government, passed down the Clyde manned by a crew from one of the Royal dockyards, under Staff-commander Rapson, R.N. She attracted considerable attention and favourable comment on the way. Work on her sister ship the *Galatea* is being pushed rapidly forward. Messrs. Walter & Hugh Neilson (sons of the late Mr. William Neilson, of Mossend Steel Works), in association with several other gentlemen, have formed a private limited company, to be called the Clyde Bridge Steel Company, for the manufacture of mild steel by the Siemen's process. A very suitable site, extending to about twenty acres, has been secured for the erection of the works near Cambuslang, some three or four miles from Glasgow, and close by the bridge on which the Caledonian Railway system crosses over the Clyde, at Clyde Iron Works. Arrangements are in active progress for getting the site connected with the railway, in order that the necessary excavations and erections may be proceeded with. It is intended to begin steel making operations with four 25-ton smelting furnaces, and the machinery that is to be laid down will in the meantime be limited to such as is required for the manufacture of plates for shipbuilding, boiler making, bridge building, and allied purposes, and a prominent feature of it will be a powerful cogging mill, which has been resolved upon in preference to the ordinary steam hammer. The engineer of the Clyde Bridge Steel Works is Mr. Thomas Williamson, who has had a great amount of varied experience in laying out steel works and designing steel making machinery in various parts of the Kingdom—in Scotland, England and Wales. It is satisfactory to note that ever since the appointment of the Royal Commission to inquire into the appliances available in our mercantile marine for preventing loss of life at sea, numerous methods and inventions in that line have been brought before the public. The most recent is an invention by James McConachy, Port Glasgow, whereby the most ordinary though every day useful article on deck can be made (without interfering in the least with the space or working of the ship) a most valuable life saving appliance in the case of a disaster at sea. This consists of making the ordinary bridges or gangways which span the spaces along the ship's deck from poop to deckhouses, deckhouses to forecastles, &c., or in paddle steamers the bridges between the paddle boxes so constructed as to have a watertight double bottom made of light well-seasoned wood, put together feather and groove with white lead rendered impervious to water, and thus adapted as life saving rafts. The deepest part of the double bottom is at the centre of the gangway and tapers off to nothing at the extremities. Two of these gangways, when fixed alongside of one another by means of thwartship roads with which each one is provided constitute a most stable craft, capable of floating a large number of persons. The ordinary hand-rail stanchions of the gangway are admirably suited for fixing to, and supporting canvas "weather cloths" as a protection against wind and water to those on the extemporised raft. Mast, sail, oars and rowlocks, form part of the outfit, and in each gangway in a compartment of the double bottom, there can be placed two light zinc tanks for water and provisions.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The state of the shipbuilding trade on this river has not altered very materially since last month. Scarcely any new orders have been booked, but that circumstance does not prevent some of the yards from presenting a slightly more active appearance, as several vessels which were then only on the initiatory stages are now somewhat advanced, and capable of affording more scope for the employment of operatives. The Elswick yard, which, after the launch of H.M.S. *Victoria*, had for a short period the whole of the berths unoccupied, has now four vessels on the stocks, two of which are cruisers of large size. A second frame furnace was put in operation a couple of weeks ago, and the number of hands employed "outside" has been steadily increasing since. There is still a vast amount of work to be done to the *Victoria*, which is lying beside the yard, having been removed thereto from the shearlegs after Messrs. Humphrey & Tennant, of London, had placed the engines and boilers on board. The last-named firm have now a staff of men engaged in erecting the engines and fitting the connections and accessories, a work which is expected to occupy many months yet. Messrs. Armstrong and Mitchell's Low Walker Yard still presents the extraordinary spectacle (for a time like the present) of a series of vessels building without a gap between them to denote that there is room for even one other to be laid down. One of the nine vessels that were on the stocks at the beginning of the month was launched before the close of the first week, and has since been replaced by another. Two others are now ready for launching, but it is believed that in these instances also the berths will have keels for other vessels placed in them within a short time after they become vacated. Frame turning for the two large vessels (each 400 ft. long), referred to in last month's report, has been commenced at Messrs. Palmer's yard, and, as in this case there seems to be some stipulation for delivery by a specified date, the system of double-shift has been resorted to. The firm have obtained an order for a third vessel, but it is of much smaller dimensions than those to which reference has just been made. It may be stated that the firm are manufacturing in their own steel works the whole of the material required in the construction of these vessels. Messrs. Hawthorn & Leslie are achieving considerable success in competing for repair work, and their graving dock is never without an occupant. The firm have only two of their building berths occupied, but the vessels in these are of very large size. After standing idle for two years, Messrs. Stephenson's yard, Hebburn, has again been opened for work, and the framing of a large steel vessel is now well under way. The yard is one of the best arranged in the kingdom, and under its present energetic management it can scarcely fail to take a leading place among successful establishments. Messrs. Swan & Hunter, Messrs. Readhead, and the Tyne Shipbuilding Company have each launched a vessel since the beginning of the month, and the first-named firm are having frames turned for a vessel to take the place of the one just off the stocks. Messrs. Schlesinger & Davis have a vessel well advanced in framing and Messrs. Dobson & Co. are proceeding with the shell plating of a vessel. Messrs. Richardson are framing and plating two vessels, and they have two on the stocks completed, which are understood to be unsold. Messrs. Wood & Skinner launched a small vessel during the month, leaving on the stocks only one, which is of more than the medium size, and is far advanced in framing. The Tyne Pontoons and Dry Docks Company continue to have full use made of their very superior facilities for painting and repairing vessels. Messrs. T. & W. Smith and Messrs. Edwards are also getting a fair share of repair work. Mr. Boolds (late partner in the firm of Boolds & Sharer, Ship-

builders, Sunderland) has been appointed manager for the last-named firm. Business in the engineering trade has shown a tendency towards further improvement during the month. Messrs. Palmer have increased the number of hands in their pattern shops, and Messrs. W. Richardson & Co. have considerably enlarged their fitting shops. Messrs. Hawthorn & Leslie's Marine Engineering establishment at St. Peter's is daily becoming busier, and their locomotive shops are more active than they have been for three or four years. Messrs. Stephenson have nine locomotive engines in progress for an Irish railway company, but they are in advanced stages, and will very soon be getting forwarded to their destination. Messrs. Hawks, Crawshay & Sons have commenced the construction of a bridge of 13 spans for India, and they are now delivering to the Consett Iron and Steel Company a very powerful engine for the new mill which the Company will shortly have ready for starting. Messrs. Abbot are having more work in their metal pipe department, and in their fitting shops, but the chain shops are still only going half-time. Messrs. Black and Hawthorn have a good deal of work in the way of gun-carriages, locomotive engines, &c., and a large proportion of their men are on night-shift. The demand for Messrs. Carrick & Wardale's specialities in steam pumps, &c., is such as to keep the factory in steady operation. The special productions of Messrs. Watson and Sons, of the High Bridge Works, Newcastle, continue to maintain a high place in public favour, as is evidenced by the unimpaired activity at their establishment.

The Wear.—The second week in June heralded in a slight improvement in the Wear shipbuilding trade. At the beginning of the month the aspect of affairs was gloomy in the extreme, for all the yards were slack, and there was not the slightest indication of any new contracts being initiated. At the time mentioned, however, it became known that two out of the half dozen unsold vessels on builders' stocks had found purchasers, and this good news was immediately afterwards supplemented by the still more cheering information that orders for three vessels of large tonnage had been secured by local builders. Messrs. Doxford's was the first firm in reference to which the announcement was made that an order had been obtained. The news that a vessel of 2,500 tons burden was to be laid down immediately was particularly welcome in this case, as the firm had nothing on the stocks but a torpedo boat, and employment could only be provided for a very limited number of hands. It was next made known that Messrs. J. L. Thompson & Sons had been commissioned to build a 3,000 ton steamer, and that Messrs. Bartram & Haswell would be in a position to put down one of about equal tonnage. All these vessels are ordered by local owners, and will be engined by local engineering firms. They will be of very superior type, and will be constructed entirely of steel. Messrs. S. P. Austin & Sons have decided to build a large steamer on the speculative principle, and this, of course, will be an important addition to the sources of prospective employment in the district. Messrs. Short Brothers have three vessels on the stocks in various stages, but the delivery of material is being carried out on an exceedingly restricted scale, and operations are consequently delayed. Operations at Messrs. R. Thompson & Son's establishment are also hindered by the same cause. At the Deptford yard the work in hand is rapidly lessening, and before many days of July are past three out of the five berths will be empty. Frame-turning was discontinued some weeks ago, and there is as yet no sign of operations being resumed in this important branch of the business. The s.s. *Lake Ontario*, built at the last-named yard for the owners of the Beaver Line of steamships, left for Liverpool early in the month, and has since been placed on the station between that port and Montreal. The *Lake Ontario*, on being tried over the measured mile, developed a speed of over 15 knots an hour, or about two knots more than was guaranteed. With reference to the engineering trade there is very little that is new to report. The North Eastern Engineering Company have four sets of completed engines in their shops, but three of these will be turned out shortly, as the vessels for which they are intended are being got ready for launching. Messrs. Doxford paid off nearly all their hands at the beginning of the month, but the acquisition of an order at a later date enabled them to re-engage some pattern makers. Messrs. Irving and Jopling, of the Pallion Boiler Works, are kept fairly busy, and Messrs. John Lynn & Co. continue to experience a good demand for their specialities. Messrs. C. & M. Douglas, of the Bedford Street and Low Quay Engine Works, have a good supply of work in both the new and repairing branches; and Messrs. W. & H. Glaholm, of the Bedford Street Brass Works, have for some time past been enabled to keep their place going night and day. This firm manufacture a special type of engine, which has been patented, and is understood to possess very superior qualities, both in effectiveness and durability. The Atmospheric Marine Governor Company having found their premises in Bridge Crescent too small for their increasing requirements, have removed to more commodious premises at the entrance to the South Dock, where they are now setting up plant of a most complete and effective kind. The Company intend adding to their business the manufacture of their new specialty, the interchangeable chain wheel for windlasses, winches, and steering gears, besides some other special articles in connection with ship equipment, which have already come largely into favour. Foundries are still slack, but some of the forges show improvement.

The Hartlepools.—Shipbuilders continue to be pretty fully employed, but inquiries for new tonnage are less numerous, and it is feared that later in the year the state of work in connection with this trade will be less satisfactory than at present. In marine engineering comparative briskness is maintained, both the important establishments at this port are kept busy, and at one of them the engines of the s.s. *Mexican*, belonging to the Cape Union line, are being converted from compound to triple-expansion. Several vessels of this line have already had their engines converted here, and it is understood that the whole of the remaining vessels constituting the fleet will be dealt with in a similar manner.

The Tees.—The outlook for shipbuilding on the Tees is not particularly encouraging just now, as orders are being finished up, and very few, if any, now ones are being secured. In engineering establishments and foundries a fairly good business is being done, and some of the finished iron works are kept going more regularly, steel works are still busy, and a decidedly encouraging aspect has been given to the future of this industry by the fact that a large order for rails has just been placed with one of the leading firms on behalf of the promoters of a railway enterprise in China.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Twin-Screw Gun Boat.—On May 10th William Dickinson launched from his yard at Birkenhead a twin-screw gun boat built to the order of the Crown Agents for the Colonies, for service at Lagos. She will be armed with one 7 pounder breech-loading gun, and three smaller service guns. In the rivers of this colony a considerable amount of piracy takes place among the natives, and with a view to suppressing this the vessel referred to has been designed by Sir E. J. Reed, K.C.B.

Albatross.—On May 23rd a new steamer was launched at Penarth. The vessel is named the *Albatross*, and has been built by the Penarth Slipway Company. She has an over-all length of 147 ft., with a breadth of 23 ft., and a moulded depth of 11 ft. 9 in. She has a raised quarter-deck, under which are the engines, which are inverted. The engines are surface-condensing, with cylinders 17½ in. and 34 in., by 24 in. stroke. The bridge-house amidships is to be used as the captain's room, while the topgallant forecastle has accommodation for the crew. She has two steam winders, and an improved frictional windlass for working the anchors. She will be rigged as a fore-and-aft steamer, with three masts, and will carry 450 tons gross register and 30 tons of bunker. The steamer will proceed to Buenos Ayres. The ceremony of launching the *Albatross* was performed by Mrs. David Roberts, the wife of the secretary of the Company.

Balmoral.—On May 24th there was launched from the yard of Messrs. Thomas Royden & Sons, Baffin-street, Liverpool, a three-masted sailing ship named the *Balmoral*, built to the order of Messrs. Macvicar, Marshall & Co., of Liverpool. Her dimensions are as follows:—Length, about 275 ft.; beam, 40 ft. 6 in.; depth, 24 ft. 3 in.; nett register tonnage, 2,000 tons; and carrying capacity, about 3,250 tons. She has been built to class 100 A1 at Lloyd's, and will have many things in excess of the ordinary requirements. Mrs. Macvicar performed the ceremony of naming.

Fastnet.—On May 24th Messrs. M. Pearse & Co. launched from their shipbuilding yard at Stockton-on-Tees a steel screw-steamer of the following dimensions:—Length between perpendiculars, 290 ft.; extreme breadth, 38 ft. 2 in.; depth of hold, 19 ft. 11 in. She will class 100 A1 at Lloyd's, and is arranged as a first-class cargo steamer. She has a steel de.k, with rails, sky-

[illegible] raised quarter-deck, break poop, [illegible] forward of foremast, topgallant forecastle, [illegible] Her engines are by Messrs. Blair and [illegible] on the triple-expansion principle, with all the latest [illegible] As she left the ways she was christened *Fastnet* [illegible] The steamer has been built to the order of [illegible] & Co., of London.

[illegible] [illegible] May 24th Messrs. W. Gray & Co. launched from their yard a steel screw steamer of the following dimensions: [illegible] ft. 6 in. by 22 ft. 3 in. moulded, of large deadweight capacity, built to the order of C. M. Webster, Esq., [illegible] Hall, Sunderland, and classed 100 A1 at Lloyds. This is the seventh vessel the builders have launched for the same owner. She is of the improved well-decked type, having the bridge extended forward of the main hatch, an arrangement which has been largely adopted since introduced by this firm in the steamer [illegible]. The poop aft contains handsome accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore part of the bridge. Emerson, Walker & Co.'s windlass is fitted forward with a capstan extending above the topgallant forecastle. The hull is built with web frames, giving strong sides and dispensing with hold beams, thus avoiding any obstruction in the working of cargo. The bottom inside is coated with enamel cement. A cellular double bottom is fitted for water ballast under the holds and engines. Five hatches, two donkey boilers, four steam winches and steam-steering gear are fitted, and the ship is thoroughly equipped as a general trader. The engines are supplied by the Builders' Central Marine Engineering Works, and are on the three cylinder, three crank, triple-expansion principle. The cylinders are 22, 35, and 59 in. in diameter, and the stroke of all the pistons is 39 in. The engines are fitted with link motion valve gear throughout, and the crank shaft is made in three equal parts, each part being equal-ended, so as to be both reversible and interchangeable. The first cylinder is fitted with an improved type of piston valve, overcoming all the difficulties involved by spring rings, whilst retaining perfect steam tightness. The second and third cylinders are fitted with double-ported and treble-ported slide valves. The engines are reversed by means of a small steam engine, and there is also a hand-reversing gear worked by means of a large wheel in front of the engines, as is usual in the engines of the Central Company, the gear being of the types known as an "all-round" reversing gear. An improved system of turning gear is also applied, doing away with the troublesome rope or chain from the donkey. The boilers are two in number, of unusually large size, so as to enable the engineers easily to keep steam up to the working pressure of 160 lbs. per square inch, with natural draught, when the engines are running at a speed producing 1,000 I.H.P. During construction the vessel has been superintended by Captain G. Wright. The christening ceremony was gracefully performed by the Misses Eleanor, Gwendoline, and Maud, triplet daughters of the late Captain Young, of Wolviston Hall, Durham, and the vessel named *Goldsbro.*

Bazalgette.—On May 25th the Barrow Shipbuilding Company launched for the Metropolitan Board of Works the twin-screw steamer *Bazalgette*, 230 ft. in length by 38 ft. beam by 13 ft. 10 in. depth of hold, and capable of carrying 1,000 tons deadweight. She is built of steel, will be classed 100 A1 in Lloyd's Register. The vessel will be propelled by twin-screw triple-expansion engines 15 in., 22 in., and 33 in. diameter, by 24 in stroke, with a working pressure of 150 lb. per square inch, and capable of steaming 10 knots an hour. She is fitted with Emerson, Walker & Co.'s new patent horizontal direct steam windlass. This steamer is the first of a series of similar vessels intended to be built to the order of the Metropolitan Board of Works for the purpose of conveying London sewage sludge from the outfalls in the river Thames out to sea.

Grangense.—On May 25th the Barrow Shipbuilding Company launched from its yard the screw steamer *Grangense* for Messrs. R. Singlehurst & Co., Liverpool. Her dimensions are 180 ft. by 26 ft. breadth moulded, by 11 ft. depth of hold, and she is intended to carry about 300 tons deadweight and steam 10 knots at sea loaded. She will be schooner rigged with two-pole masts. She is built of steel, and will be eligible for the 100 A class in Lloyd's Registry of shipping. The ship will be propelled by triple-expansion engines of 500 I.H.P., with a working pressure of 150 lb. per square inch. She is fitted with Emerson, Walker & Co.'s new patent horizontal direct steam windlass. The vessel will shortly be completed, when she will be ready to go to her station in South America.

Ariel.—On May 27th this vessel was launched from Messrs. J. F. Waddington & Co.'s shipyard at Seacomb, near Liverpool.—Length, 55 ft.; beam, 10 ft.; depth, 5 ft. She is built to the order of Captain Main, for passenger service in South America, and is fitted with saloon teak skylight, seats, lavatory &c., forward of machinery, awning fore and aft. She subsequently had a trial on the Mersey, and easily attained the contract speed of 10 knots on the measured mile, giving every satisfaction to the owner and party on board. Messrs. Waddington have just received an order for a fine sea-going launch with compound machinery for the Brazilian Government through the Government's Agents in London.

Charters Tower.—On June 7th there was launched from the iron shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, the largest steamer that this firm has yet built. The dimensions are:—300 ft. in length, by 40 ft. by 25 ft. 6 in. The vessel is built of steel, and is classed 100 A1 Lloyd's special survey; is a three-decked vessel, with bridge over engine and boiler space, and topgallant forcastle; built on the cellular bottom principle, and schooner-rigged. She is fitted with triple-expansion engines, also built by Messrs. Readhead & Co., having cylinders 22 in. 36 in., and 60 in., by 39 in. stroke, and will be supplied with steam at 160 lbs. pressure from two extra large steel boilers, fitted with Fox's patent furnaces. She has been built under the superintendence of Mr. H. C. Ashlin, of London and Liverpool, assisted by Captain M'Nabb. The vessel was named the *Charters Tower* by Captain M'Nabb, and has been built to the order of Messrs. F. Stumore & Co., of London, for their Tower Line of steamships.

Alvina.—On June 8th there was successfully launched from the shipbuilding and engineering works of Messrs. Oswald, Mordaunt & Co., a handsomely modelled iron screw steam yacht of 250 tons, built to the order of R. Clifford Smith, Esq., of Manchester, and designed by W. C. Storey, Esq., Naval Architect. Dimensions:—Length, extreme, 153 ft. 6 in.; breadth, 20 ft. 2 in.; depth, 11 ft. 9½ in. The vessel has a clipper bow with handsome figure head, and elliptical stern. A large teak deck house is fitted amidships, forming entrance to saloon, smoking room galley at after end of same, and above is a spacious promenade with flying bridge to ship's side. The saloon and staterooms are tastefully fitted up in polished teak with Lincrusta Walton panels. The accommodation for officers and crew is at the after end of the vessel. The engines are triple-expansion type, having three cylinders, 12 in. 18 in. and 30 in. diameter by 21 in. stroke, fitted with Joy's patent valve gear. Large steel boiler with Fox's corrugated furnaces, constructed for working pressure of 160 lbs. per square inch. The yacht was launched with steam up, and on leaving the ways was named the *Alvina*, by Miss Mordaunt, after which she steamed away on her preliminary trial trip, which was very satisfactory.

Exe.—On June 8th there was launched from the shipbuilding yard of Messrs. Joseph L. Thompson & Sons, Sunderland, a steel steamer of the following dimensions, viz.:—Length, 275 ft.; breadth, 38 ft.; depth of hold, 20 ft. 6 in.; built to the order of the Mercantile Steamship Company, Limited, of London, who were represented by Mr. James Buchanan, secretary to the Company. The construction of the vessel is on the web frame and longitudinal plate intercostal system, being under special survey for the 100 A1 class at Lloyd's, of the raised quarter deck type, having long bridge house, extending to the fore part of foremast, in which accommodation is provided for the seamen and firemen, special means being arranged for these berths being well ventilated. The decks are entirely of steel, the cargo holds being subdivided by six steel bulkheads, to which each longitudinal intercostal is efficiently connected. The deck machinery consists of direct steam windlass, four large horizontal steam winches by Lynn, of Pallion, combined hand and steam gear by Amos & Smith, and patent screw gear aft; stockless anchors will be fitted, and all the improved appliances of the modern steamer for general cargo purposes. The engines are of the triple-expansion type, and are being built by Messrs. Blair & Co., of Stockton, and are of 1,000 I.H.P., having two steel boilers working at a pressure of 160 lbs. per square inch. The construction of the ship and engines have been under the supervision of Mr. Terrot Glover, of Sunderland. The ceremony of naming the vessel the *Exe* was performed by Miss Florence Buchanan, of London, daughter of the secretary to the Company, the launch being witnessed by a large company of ladies and gentlemen.

Gulf of Aden.—On June 8th there was launched from the yard of her builders, Messrs. Raylton Dixon & Co., a vessel named the

Gulf of Aden, which is one of two vessels at present building for the Greenock Steamship Company, Limited, and respectively the fourth and fifth, which they have built for the same owners to be employed in their Australasian Line. She is built on three deck rule to the highest class at Lloyd's, of the following dimensions: —Length 312 ft. 6 in. by 40 ft. by 25 ft. 2½ in., and will carry 3,500 tons D W; has water ballast in chambers, with long poop, bridge and forecastle extending almost her whole length, and every convenience up to the most modern style for first-class merchant steamer, and fitted with direct steam windlass and capstan on same deck, Messrs. Emerson, Walker & Co.'s patent. In addition she is fitted with handsome saloon and cabins for 30 first-class passengers. She will have engines of 300 H.P. by Messrs. Blair & Company, Limited, of Stockton. On leaving the ways she was christened the *Gulf of Aden* by Miss Blair.

Swansea.—On June 8th Messrs. W. Gray & Co. launched a fine steel screw steamer, 324 ft. long. 40 ft. wide, and 29 ft. 6 in. deep, built to the order of Messrs. Hooper, Murrell & Williams, of London. The vessel takes Lloyd's highest class, will carry over 4,000 tons deadweight, and is to run between London, Swansea, and Baltimore, being the latest addition to the Atlantic Transport Line of steamers, which includes the *Surrey* and the *Maryland*, also built by Messrs. Gray & Co. The new vessel has a steel spar deck sheathed with wood, a steel main deck, and a tier of beams in the holds suitable for a third deck, and the poop, bridge, and forecastle are joined by a shelter deck for cattle. The bottom is constructed on an improved cellular double bottom principle. Six watertight bulkheads are fitted, and a permanent iron fore and aft bulkhead in holds to prevent shifting of cargo. Two strakes of shell plating are double at the bilge and topsides, above Lloyd's requirements, and in addition to a deep bar keel, bilge keels are fitted. Three pole masts will be fitted, with yards on the fore mast, and a smart rig. Four hatches, with a powerful steam winch at each, and connected to work the bilge pumps, a steam windlass with capstan on the forecastle, steam steering gear in house amidships, and screw steering gear aft. Two donkey boilers, a distiller to supply 4,000 gallons of fresh water per day into large deck cattle tanks and overflow into fore peak tank. A handsome saloon, state rooms for a few passengers, captain's rooms, ice house, &c., are fitted up in the poop. The officers are berthed at the fore part of the bridge. Arrangements of the most approved kind are made for conveying about 450 cattle, and a large number of ventilators are fitted to ensure a good supply of fresh air to every part, side coaling and cargo ports are fitted, and everything is provided which can contribute to the safety and efficiency of the vessel. The engines are of the triple-expansion type, working on three cranks. They are supplied by the Builders' Central Marine Engineering Works, and possess all the latest improvements which the experience of the firm in triple-expansion engines has produced. The cylinders are 24½, 40, and 65 inches in diameter, and the stroke of all the pistons is 42 inches. The details of the engines are similar to those of the s.s. *Maryland*, which has just crossed the Atlantic for the fifth time in between eleven and twelve days, carrying over 4,000 tons of cargo, with the most satisfactory results. The boilers are of the double-ended type, and designed for a working pressure of 160 lbs. per square inch. They are exceptionally large, are intended to work under natural draught, supplying steam for the development of 1,200 I.H.P. in regular work at sea. The speed will be about 11 knots an hour. The engines and boilers have been built under the superintendence of Mr. A. E. Allen, of Hull, the engineer superintendent for the owners. The contract has been carried out under the superintendence of Mr. F. Murrell, one of the owners, who has personally superintended the building of the ship. The christening ceremony was gracefully performed by Mrs. George B. Baker, of Baltimore, U.S.A., wife of one of the managing directors of the Baltimore Storage and Lighterage Co. (owners of the *Maryland*), who named the steamer *Swansea*. Mr. George Baker and Mr. Hooper, directors of the Atlantic Transport Line, were also present. Captain H. Murrell, late of the *Surrey* s.s., takes command of the *Swansea*, which will be ready for sea this month.

Cragside.—On June 11th, Messrs. Wood, Skinner & Co. launched from their yard at Bill Quay, Newcastle-on-Tyne, an iron screw steamer, built to the order of Robert Mason. Esq., of the firm of L. S. Carr & Co., Newcastle-on-Tyne. The principal dimensions are :—92 ft. by 20 ft. by 8 ft., with a deadweight carrying capacity of 170 tons. The vessel has been built under Lloyd's special survey for the 100 A1 class, and will be fitted with compound engines 12 in. and 22 in. by 16 in. stroke. She is intended for the coasting trade, and has been specially arranged for carrying heavy machinery. On leaving the ways she was christened the *Cragside*, and immediately after the launch was towed to the works of Messrs. John Abbot & Co. (Limited), Gateshead, to receive her machinery.

New Amsterdam.—On June 14th, at the yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel twin-screw steamer was launched, of the following dimensions :—Length between perpendiculars, 100 ft.; breadth, 16 ft. 11 in.; depth, 7 ft. The vessel is built to the order of Messrs. Hugh Sproston & Son, of Demerara, and is intended for the passenger trade in the native rivers. The craft will be engined by Messrs. Black, Hawthorn and Co. On leaving the way the vessel was named the *New Amsterdam* by Mrs. G. B. Hunter, wife of the builder.

Bateau-Citerne.—On June 18th there was launched from the yard of Palmer's Shipbuilding and Iron Company (Limited), at Jarrow, a small vessel for the Panama Canal Company. She is built for carrying fresh water, and will be used in connection with the construction of the canal. As the vessel left the ways she was named the *Bateau-Citerne* No. 2 by Miss Hall, daughter of Mr. J. P. Hall, engine works manager, of the Palmer Company.

Starling.—On June 18th at the shipbuilding yard of Messrs. Palmer and Co., at Jarrow, the screw-steamer *Starling*, built for the General Steam Navigation Company, London, was launched. The vessel, which was christened by Mrs. Maxwell Hill, is intended for the cattle and general goods trade. She is 210 ft. long, 30 ft. broad, and 15 ft. deep, and has full poop extending to the foremast and topgallant forecastle. There is accommodation under the poop for the captain and officers, and for the crew in the forecastle. The vessel is adapted for carrying water ballast, and with the view of rapidly discharging cargo four powerful steam cranes have been fitted on board, also Emerson Walker and Co.'s improved patent horizontal steam windlass for working the anchors. Captain Marshall has superintended the building of the vessel, which has a carrying capacity of 1,000 tons, and which will take the highest class at Lloyd's. The *Starling* will be fitted with triple-expansion engines, also built by the Palmer Company, the cylinders being of 18 in., 29 in., and 47 in., with a 33 in. stroke, and the H.P. being 120 nominal.

Drudge.—Sir W. G. Armstrong, Mitchell, & Co., have lately launched a vessel of a novel description named the *Drudge*. She is a screw steamer of 400 tons burthen, and is intended for the firm's own use as a hopper barge in carrying waste material to sea from Elswick. But she is also arranged so that guns of 110 tons, or even more, can be mounted and taken out to sea for testing, or if required be used in warfare.

Gwynfaen.—Messrs. John Jones & Sons, Brunswick Dock, recently launched the screw-steamer *Gwynfaen*, built for Messrs. Kneeshaw, Lupton, & Co., of Liverpool. The dimensions of the vessel are 140 ft. by 20 ft. by 10 ft. depth of hold, and she has topgallant forecastle and long raised quarterdeck. She is built to the highest class at Lloyd's, and is fitted with water ballast. She is rigged as a three masted schooner, and has steam winches and other appliances for the rapid discharge of cargo, and will be fitted with compound engines made by the builders at their engine works, Cotton-street. Since our last visit to this building yard we observe that new ground has been rented from the Mersey Docks and Harbour Board, and very powerful machines for the heaviest class of shipbuilding have been put to work. On the adjoining slip the builders have a large steel screw-steamer, 5,500 tons displacement, built with cellular water bottom, and the highest class at Lloyd's. Since the reduction accepted by the workmen of the port early this year we are informed that all classes of steamers and ships may now be built on the Mersey at at the same prices as paid to outside builders, and no doubt the local owners will endeavour to encourage the trade of the port by placing their orders with local firms.

Linda.—The Tyne Iron Shipbuilding Company, Limited' have lately launched from their yard a steel screw steamer named the *Linda*. She is of the following dimensions: 290 ft. by 40 ft. by 27 ft., moulded, with triple-expansion engines by Messrs. Wigham, Richardson and Co. This vessel has been built to the order of Messrs. Hunting and Patterson, of London and Newcastle

LAUNCHES.—Scotch.

London Hill.—On May 24th Messrs. Russell & Co. launched from their Kingston yard at Port-Glasgow, a large iron sailing ship, of 2,030 tons net register, and of the following dimensions: —Length, 283 ft.; breadth, 40 ft. 6 in.; depth of hold, 24 ft. 6 in.

On leaving the ways she was named *Loudon Hill*. She has been built to the order of Messrs. J. R. Jackson & Co., Glasgow, and will be commanded by Captain Hall, and will be completed and loaded for a foreign port in the James Watt Dock, Greenock.

Pukaki.—On May 24th Messrs. William Denny & Brothers launched from their Leven shipbuilding yard at Dumbarton a first-class steel-built steamship, named *Pukaki*, of 1,300 tons gross measure, for the passenger and cargo trade of the Union Steamship Company of New Zealand (Limited). This ship will be supplied by Messrs. Denny & Co. with quadruple expansion engines of about 700 I.H.P. Miss Julia Darling, of 34, Queen Square, Glasgow, daughter of Mr. Darling, the Union Company's superintendent, performed the christening ceremony.

Atalantis.—On May 25th there was launched from the yard of Messrs. Ramage & Ferguson a steel yawl of 52 tons, named the *Atalantis*, built to Lloyd's highest class, to the order of Lawrence Ames, Esq., the owner of the *Xarifa*, who entered the new vessel for the Jubilee Race. All her anchors are Wasteneys Smith's patent stockless.

Kittiwake.—On May 25th Messrs. J. M'Kenzie & Co. launched from their yard at Leith a wooden steam fishing vessel, 70 ft. in length, 17 ft. in breadth, and 9 ft. in depth, built to the order of Mr. T. F. Robertson Carr, of North Shields. The vessel, which was named the *Kittiwake*, will be supplied with engines by Messrs. Hawthorns & Co., Leith. Messrs. M'Kenzie received the highest award for a model of these vessels at the International Exhibition.

Empress.—On June 4th the Fairfield Shipbuilding and Engineering Company (Limited) launched a large steel paddle steamer of about 1,200 tons register. This steamer has been specially constructed for service in the English Channel, and is similar in design to the paddle steamer *Victoria*, launched last year by the same firm, having a rudder at each end to facilitate her leaving the harbours. Her dimensions are as follows:—Length between perpendiculars, 325 ft.; breadth, 34 ft. 9 in.; depth moulded to upper deck, 22 ft. She is built entirely of steel, and is divided into eight watertight compartments. This extra close division of the hull greatly reduces the danger of sinking in the case of any part of the shell being pierced and admitting the water. The doors in the bulkheads between engine and boiler spaces are fitted with self-closing gear, so that they can be closed instantaneously. The cabin and other accommodation for passengers has been carefully arranged for their comfort and convenience. The after part of the steamer on the lower deck is fitted up entirely for the first-class passengers, with ladies' saloon and main saloon extending the full width of the vessel. Both of these are commodious apartments, well lighted and ventilated, and they will be upholstered and furnished in an elaborate style. A refreshment saloon is fitted up forward of the main saloon, having large tables, revolving chairs, &c. Entrance is obtained to the saloon and cabin by large stairways from the main deck. On the after part of the main deck a comfortable smoking-room is fitted up for the use of the first-class passengers. In the deckhouse a large state saloon has been fitted up in a luxurious manner, as also several private cabins for the use of passengers who may be desirous of travelling privately. The sides of the vessel at this part have been left open from the main rail to the deck above for the purpose of light and ventilation, but forward of the paddle-boxes the side plating is carried up to the upper deck, thus forming an excellent shelter for the second saloon passengers. Cabin accommodation for the second saloon passengers, officers, and crew is provided in the forward part of the lower deck, and will be fitted up in a substantial and comfortable manner. The chart-house is fitted on the upper deck amidships, with a flying bridge overhead. The steamer is being fitted with a set of compound diagonal direct-acting engines, having two cylinders with surface-condenser, the high-pressure cylinder being 58 in. in diameter, the low pressure 104 in., both being adapted for a stroke of 6 ft. The high-pressure cylinder is placed above the low-pressure cylinder, and both are fitted with slide valves, which are worked by the usual double eccentrics and link motion, and are reversed by one of Messrs. Brown Brothers' steam and hydraulic reversing engines. The main working parts of the engines are made of steel, and the castings are of steel where practicable, all for the purpose of combining strength with lightness. The paddle shafts, cranks, and crank pins are made of Vickers' steel, the shafts and pins being hollow, so as to reduce the weight. The water for condensing the steam will be circulated through the condenser by a centrifugal pump driven by a separate engine. The paddle wheels have feathering floats, and together with the paddle arms, feathering rods, &c., are made of steel. The boilers for supplying steam to the engines are four in number, being double ended, and fitted with Fox's corrugated flues, the total number of furnaces being 24. The boilers are constructed of steel, and are adapted for a working pressure of 110 lbs. per square inch. Fans and engines will be fitted in the stokehole, and arrangements made for supplying air to the furnaces, so that the boilers may be worked with forced draught. The steamer is provided with all the latest improvements, including a complete installation of electric lighting, with embarkation lamps, steam capstan windlass forward, steam-working capstan, steam and hand-steering gears for after rudder, hand-steering gear for bow rudder, Downton pumps, lifeboats with quick lowering gear, life rafts, &c. The dog shores holding the vessel were released by Lady Waterlow, who gracefully named her *Empress* as she moved down the ways.

Argus.—On June 8th Messrs. Hannah, Donald & Wilson, shipbuilders, Paisley, launched a screw steam tug steamer of 80 tons gross measurement, built to the order of a foreign firm. The dimensions are:—Length, 80 ft. 6 in.; beam, 18 ft. 6 in.; and depth, 9 ft. 6 in. She is named the *Argus*, and has compound surface-condensing engines of 45 N.H.P., constructed by the same firm.

Altmore.—On June 9th Messrs. Robert Duncan & Co. launched from their shipbuilding yard at Port Glasgow a steel sailing ship of the following dimensions:—Length, 255 ft.; breadth, 39 ft.; depth, 23 ft.; and 1,750 tons register, built to class 100 A1 at Lloyd's under special survey. As the vessel left the ways she was named the *Altmore* by Miss Alice Thom, daughter of Mr. R. W. Thom, one of the owners, and was afterwards towed to the harbour, there to receive her masts, spars, and outfit. She will then be taken to Glasgow, where she will load a general cargo for Bombay. The *Altmore* is the fifth vessel built by Messrs. Robert Duncan & Co. for Messrs. Thom & Cameron, Glasgow (the previous vessels being *Shannon*, *Helensburgh*, *Barrtmman*, and *Rahane*), this fleet having an aggregate registered tonnage of 8,150 tons, and all built since 1883. This last addition to their fleet is fitted up with all the latest improvements, among which are Mill's patent main bilge and force pumps combined, entirely doing away with the necessity for separate force pumps, as by this combined arrangement the force pump can be worked by the same flywheel and crank as the main pumps. The maker is Mr. Robert Mills, Greenock. Under the forecastle deck is fitted one of Napier's patent direct steam windlasses with capstan in forecastle head. On the main deck at fore and main hatches are two of M'Bryde's horizontal steam winches supplied by steam from a donkey boiler at a pressure of 60 lbs., connected to which is a fresh water condenser capable of supplying 1,000 gallons of drinking water per day. The companion, charthouse, cabins, and skylight are all fitted with M'Conachy's patent ventilators. The space between poop and after-deckhouse is bridged by a gangway 20 ft. long, which will be used in harbour as an accommodation ladder; the spaces between the fore-and-after deckhouses and forecastles are spanned by two gangways 26 ft. each and two at 14 ft. each—all being fitted to act as rafts, having watertight compartments capable of carrying provisions and water for those whom may be under the necessity of requiring to use them as life-saving rafts. They can be detached from their fixings almost instantaneously. Being fitted with cross binders or stays, two can be placed alongside each other with a space of a few feet between, but still connected in such a way as to constitute a most stable raft capable of carrying a large number of persons. The signal lamps are fitted into two neat lighthouse towers, made of steel with bright copper domes. The *Altmore* was superintended during construction by Captain Walter Pasifull, who has superintended all the vessels built by Messrs. Duncan for Messrs. Thom & Cameron. She will be commanded by Captain Weeks, late of the *Helensburgh*.

Gem.—On June 9th there was launched from the building yard of Messrs. John Fullerton & Co., Paisley, a handsome iron screw steamer of 500 tons gross, built to the order of Mr. William Robertson, 88, Great Clyde Street, Glasgow, and which will be employed in the general coasting trade. The vessel has been fitted with all the latest improvements for expediting the loading and discharging of cargo, double bottom for water ballast on the cellular principle, &c. The engines, of 85 H.P., of the triple-expansion type, will be supplied by Messrs. Wm. King & Co., Dock Engine Works, Glasgow. The vessel was named the *Gem* by Miss Smith, Starruca, Pa., United States of America.

Maranhao.—On June 9th Messrs. James & George Thomson launched from their shipbuilding yard at Clydebank a screw

steamer named *Maranhao*, built to the order of the Brazilian Steam Navigation Company, of Rio de Janeiro for passenger trade between that place and the ports on the river Amazon. The vessel, which is constructed of steel, is of the following dimensions:—Length, 276 ft.; breadth, 38 ft.; depth, 22 ft. 3½ in.; her tonnage being about 2,000 tons. Although the route to be taken by her is a "fair weather" passage, she has been equipped as a first-class sea-going ship, and has obtained the highest class in Lloyd's register. Accommodation for about 100 first-class passengers is furnished in the main and lower decks abaft the engine-room. The general saloon is decorated and upholstered with artistic elegance, and the dining saloon, which is on the lower deck, is provided with all conveniences. The smoking room is on an awning deck, with the captain's room and wheel-house. Forward in 'tween decks, which are lofty, room has been provided for conveying 400 steerage passengers. The engines to propel the ship are of the triple-expansion type, and will indicate about 2,500 H.P. Steam is supplied by two large steel boilers. The vessel which will be rigged as a schooner, has been fitted with all modern appliances for discharging the cargo expeditiously and economically. The construction of the ship has been superintended, on behalf of the company, by Mr. Elijah Robinson, engineer of the Brazilian Company. As the vessel left the ways she was named the *Maranhao* by Mrs. Robinson, the wife of the superintending engineer.

Bellenden.—On June 14th there was launched from the shipbuilding yard of Messrs. D. & W. Henderson & Co., Meadowside, Partick, a large steamer of 4,000 tons, built to the order of Messrs. Bell Brothers and M'Lelland, Glasgow. The steamer, which is similar to the *Bellaura* and *Bellina*, launched recently from the same yard, is of the following dimensions:—Length, 310 ft.; breadth, 39 ft.; depth, 26 ft. 6 in. She is to be propelled by triple-expansion engines of 1,500 H.P. effective, to be fitted on board by the same builder. The steamer is supplied with the most recent appliances for working both ship and cargo, and is intended as a general trader. A handsome saloon is fitted in the poop aft for the accommodation of passengers. The ceremony of naming the new steamer *Bellenden* was gracefully performed by Mrs. Mann, wife of one of the partners of the firm of owners.

Halcyon.—On June 18th, a paddle steamer was launched from the Abden shipbuilding yard. She has been built by Messrs. John Scott and Co., engineers and shipbuilders, Kirkcaldy, for the General Steam Navigation Company. Dimensions:—Length, 220 ft.; breadth, 26 ft.; depth, 9 ft. On leaving the ways the vessel was christened the *Halcyon* by Mrs. Marshall, and was afterwards towed round to Kirkcaldy, where it will be fitted with six s.c. engines of 250 H.P.N. The vessel is built of mild steel, and is expected to attain an average speed of 18 miles per hour.

Gemileh.—On June 20th there was launched from the shipbuilding yard of Messrs. Lobnitz & Co., Renfrew, a twin-screw hopper barge, which has been built to the order of the Suez Canal Company. The barge was named the *Gemileh*. In measurement it is 400 tons, and its dimensions are 135 ft. long by 25 by 11 ft. 6 in. deep. It will be propelled by two independent pair of compound engines, indicating collectively 300 H.P. The engines have also been supplied by the builders.

Oronsay.—On June 20th Messrs. Charles Connell & Co. launched from their shipbuilding yard at Scotstoun, a steel screw steamer of about 2,209 tons gross register, which they have built to the order of Messrs. James Gardiner & Co., shipowners, Glasgow. The vessel, which was named *Oronsay* in the customary manner by Miss Ritchie, Edinburgh, is fitted with all the most recent improvements for safety and the expeditious loading and discharging of cargo. The engines, which are being supplied by by Messrs. John & James Thomson, Finnieston Engine Works, Glasgow, are on the triple-expansion principle, working at a pressure of 160 lbs., and are fitted with Weir's patent feeding engines and feed-heater. Immediately after the launch the vessel was taken to Stobcross crane to have machinery put on board and completed.

Alca.—On June 21st Messrs. Scott & Co. launched from their yard at Cartsdyke, Greenock, a steel steam yacht, measuring 70 tons (Thames measurement), for Colonel Malcolm, of Poltalloch. The dimensions of the new yacht, which is named the *Alca*, are:—Length, 80 ft. 6 in.; breadth, 14 ft. 1 in.; and depth, 8 ft. 9 in. The Greenock Foundry Company have supplied her with triple-expansion engines to indicate 150 H.P., and with steel boiler, the working pressure of which is 150 lbs. to the square inch. The *Alca* was launched with steam up, and proceeded on her trial trip shortly afterwards.

Elb.—On June 21st Messrs. Russell & Co., shipbuilders, launched from their Kingston yard, Port Glasgow, an iron sailing ship, built to the order of Mr. James Nourse, of London. The new vessel was named the *Elb*, and is of the following dimensions:—Length, 257 ft.; breadth, 38 ft.; depth of hold, 23 ft.; tonnage, 1,620 tons net register. The *Elb* will be towed to the James Watt Dock, Greenock, to complete her outfit, after which she will proceed to Liverpool to load for Calcutta. This is the sixth vessel Messrs. Russell & Co. have built for Mr. Nourse.

Magnet.—On June 21st Messrs. T. & H. Morton & Co., Leith, launched from their yard an iron screw steamer, 75 ft. in length, 15 ft. in breadth, and 7 ft. 10 in. in depth. The vessel, which was named the *Magnet*, has been built to the order of Captain Duncan, London, and will be supplied by the builders with compound surface-condensing engines, 8 and 16 in. diameter, and 12 in. stroke. The *Magnet* is to be employed as a tender to the mail steamers at the Cape.

Grace Darling.—Messrs. Fleming & Ferguson, Paisley, launched from their shipbuilding yard on the Cart a schooner rigged steam yacht of 240 tons, yacht measurement, built for Messrs. John Inglis & Co., Glasgow. The dimensions are:—Length, 157 ft., beam, 19½ ft., and depth, 11 ft. She is fitted with quadruple-expansion engines, and is magnificently furnished. As she left the ways she was named the *Grace Darling*.

LAUNCH.—French.

Marceau.—This first-class French ironclad, the *Marceau*, has lately been launched at La Seyne-sur-Mer, near Toulon. The vessel is built upon lines very similar to those of a Spanish vessel, the *Pelayo*, which was launched at Toulon a short time ago. The length over all of the *Marceau* is 338 ft., with an extreme breadth of 66 ft., and a depth of 43 ft. She draws 26 ft. of water, and has a total displacement of 10,600 tons. The spur placed in her bow is of bronze, and is 10 ft. long. The hull is made of steel, except the keel, which is iron. The *Marceau* has three full decks, and is divided into fifteen transverse watertight compartments internally. The weight of the hull is 3,875 tons, and the plates on the ironclad deck are 4 in. thick, and they extend the full length of the vessel. The engines, boilers, powder magazines, and the apparatus to be used for manœuvring the heavy artillery will be well protected, the weight of the plates on the sides of the vessel, the deck, and the turrets exceeding 3,000 tons. The weight of the engines is about 626 tons, and that of the boilers about 341 tons. The *Marceau* is expected to attain a speed of 18 knots. She is to be armed with four 14-in. guns placed in four barbette turrets, which are placed in the longitudinal axis of the vessel, one forward and another aft, with two others in the lateral axis, larboard and starboard, so that the range of fire may be quite free. The lighter artillery will include seventeen 6-in. guns in the battery, while revolving and rapid firing guns will be placed in various parts of the vessel. There will also be four torpedo tubes.

LAUNCH.—German.

Virgilia.—On May 7th the Flensburg Shipbuilding Co. launched from their stocks a new passenger-steamer, built for the Hamburg Pacific Line in Hamburg. She is a spar-decked vessel, built of iron and has a double bottom on the cellular system. The dimensions are:—291 ft. by 35 ft. 6 in. by 24 ft. 8 in. Passengers accommodation is arranged amidships under the bridge, and contains an elegant saloon and berths for 20 first-class passengers. The engine, also built by the Flensburg Shipbuilding Co., on the the triple-expansion principle, will indicate 1,200 H.P. As she left the ways she was named the *Virgilia* by Miss B. Molzen.

LAUNCHES.—Swedish.

Single Paddle-wheel Steamer.—On May 6th a steamer of a somewhat unusual construction was launched at the shipyard of W. Linberg's Engineering Company, Stockholm. It has one paddle wheel aft, and is only intended to draw 2 ft. 7 in. of water; it has a length of 109 ft., and a breadth of 25 ft. The engine is a 40 H.P. horizontal compound, and is placed on the deck aft with direct connection with the paddle-wheel. To counterbalance the engine, the boiler is situated at the bow, also on the

deck, this arrangement leaving the whole space under deck empty. The steamer has been ordered by the Sköuviks Aktiebalag for the Indals River.

Forshaga.—On May 14th the Eriksberg Engineering Company, Sweden, launched the steamer *Forshaga*, built for the Forshaga Steamship Company, and intended to trade between Gothenburg and Karlstad. The new steamer is built of Swedish Martin steel; its length is 107½ Swedish feet, and the breadth 22 ft. 10 in. With a load of 300 tons, it should draw 9½ ft. The engines are of the Woolf system, and of 25 N.H.P. There are two saloons for passengers and several smaller cabins.

TRIAL TRIPS.

Shandon.—On May 23rd this steamer, one of the City of Cork Steamship Company's liners, went down the river on her official trial trip, after having new machinery fitted to her, and extensive alterations and improvements effected to her hull by Messrs. David Rollo and Sons, Fulton Engine works, Liverpool. The new engines are of the 3-crank triple-expansion type, and have cylinders 21½, 36, and 58 in. diameter respectively, with a stroke of 36 in. The engines are of very simple, strong, and open design, having ordinary double eccentric valve gear, with all the valves placed in line above the crankshaft, and combined steam and hand-reversing gear on the revolving principle has been fitted. The condensing water is supplied by a centrifugal pump, while there are two complete sets of duplicate air, feed, and bilge pumps. The pumps are worked by an independent set of triple-expansion engines. Steam is supplied by two large double-ended steam boilers, having a working pressure of 155 pounds per square inch. The whole of the machinery is to the requirements of the Board of Trade. The *Shandon* is a vessel of 882 tons gross register; she is 251 ft. between perpendiculars, 28 ft. 2 in. beam, and 17½ ft. depth of hold. On her trial her mean draft was 12 ft. 3 in., and with her engines running 81 revolutions per minute, the mean speed was 13¼ knots per hour, which was considered highly satisfactory. The whole of the contract has been carried out under the personal supervision of Mr. G. A. Calvert, the company's superintendent engineer.

Vaillant.—On May 24th the new tug steamer, *Vaillant*, built by Messrs. Lobnitz & Co., Renfrew, for the Panama and Suez Canal Company, had her official trial trip on the Clyde, the result of which was a speed of 11 knots per hour, being one knot in excess of the speed stipulated for in the contract. The steamer measures 100 ft. by 18 ft. by 10 ft., her weight is 150 tons, and she is propelled by engines of 200 H.P.

Clandeboye.—On May 26th this saloon passenger steamer left the yard of her builders, Messrs. Workman, Clark & Co., Limited, with a large party of gentlemen to test her steaming capabilities in Belfast Lough. The measured mile was run four times and resulted in a mean speed of 18½ miles per hour. The vessel then proceeded for an extended cruise, returning to Belfast in the evening. The *Clandeboye* is of steel, is 225 ft. long, 24 ft. in breadth, and 8 ft. 9 in. deep, and has two saloons on deck, with two dining cabins below, fitted throughout on the most approved system and upholstered in excellent taste, affording the most modern passenger accommodation. The engines by Hutson and Corbett, Glasgow, consist of two cylinders, 45 in. diameter by 5 ft. 6 in. stroke, supplied with steam of 52 lbs. pressure from two steel tubular boilers. The vessel has been built to the order of the Belfast, Bangor, and Larne Steamship Company, Limited, and the hull and machinery constructed under the superintendence of Mr. Walter Chambers, consulting engineer, Belfast.

Prince of Wales.—On May 26th the new paddle steamer Prince of Wales, constructed by the Fairfield Shipbuilding Company for the Isle of Man, Liverpool, and Manchester Steamship Company (Limited), made her official trip down the Firth of Clyde as far as Ailsa Craig, and from the speed she attained she has proved herself to be one of the fastest steamers afloat, if not the fastest. At one part of the journey she was careering through the water at the rate of 24½ knots per hour, but her official return for a long distance—that is from the Craig to Cumbrae Light—was 22·6 per hour, or equal to 26 land miles. The *Prince of Wales* is sister ship to the *Queen Victoria*, which has just made the trip from Liverpool to Isle of Man in the quickest time on record. She has two massive funnels like those of an Atlantic liner, while her promenade deck extends from stem to stern. Her length is 340 ft.; breadth, 39 ft.; depth, 24 ft.; and her tonnage is over 1,500. She will carry 1,600 passengers in addition to 60 of a crew. In every respect she will be a popular vessel with tourists, and the officials expressed themselves highly satisfied with her appearance and performance. To avert a calamity in the event of a collision she has eight water-tight bulkheads, seven of which are carried up to the main deck, and the water-tight doors between the engine and boiler space are fitted with self-closing arrangements. Hundreds of passengers can promenade on the upper deck, while immediately under a similar number are sheltered from the weather, the view on both sides being open. First-class passengers are located in the after part, the second-class saloon being under the main deck forward of the machinery space. Special attention has been devoted to safety appliances, four huge lifeboats with patent detached hooks being hung ready for lowering instantly, and there are also numerous seats which, overturned, are converted into lifeboats. On the deck seats are a thousand cork seats which could be used as lifebuoys. The *Prince of Wales*, like her sister ship the *Queen Victoria*, is fitted up with a set of compound diagonal and direct-acting engines to indicate 7,000-H.P., having two cylinders and surface-condensers. The diameter of the high pressure cylinder is 61 in., and the low pressure 112 in., and both are adapted for a stroke of 6 ft. 6 in. The high pressure is placed above the low pressure cylinder, and both are fitted with slide valves working by the ordinary double eccentric and link motion, and reversed by one of Messrs. Brown Brothers' steam hydraulic engines. The main working parts of the engines are made of steel, and the castings when practicable are also made of the same metal, in order to combine strength with lightness. The paddle shafts, crank, and crank pins are made of Vickers' steel, while the shafts and pins are hollow, so as to reduce the weight. The water for condensing the steam will be circulated through the condenser by a centrifugal pump driven by a separate engine. The paddle wheels have feathery floats, and, together with the paddle arms, the feathering rods, &c., are made of steel. The engines are supplied with steam by four double-ended boilers, 15 ft. diameter, and 19 ft. 6 in. long, which are fitted with Fox's patent corrugated furnaces; the total number of furnaces being 24. The boilers are constructed of steel, and adapted for a working pressure of 110 lbs. per square inch. The steam-steering gear is by Messrs. Hugh and Caldwell, Glasgow. The vessel, commanded by Captain E. T. Irvine, left in the afternoon for Liverpool.

Tantallon Castle.—On May 28th the official trial trip of this vessel took place, a particularly fine day for testing her sea-going qualities, there being a strong south-west wind blowing, and a high sea running, the full force of which was felt in the run down to the measured mile in Aberlady Bay. The vessel proved herself to be an admirable sea boat, and well adapted for the comfort of passengers in the intended sea trips of the Galloway Line. Not a single drop of water was shipped on deck, and in the cross sea there was a decided absence of rolling. When the measured mile was reached the trial was made first against wind and sea, and then with them, the mean speed, or about 55 lb. pressure, was 14½ knots good, which, with a little more pressure, can be increased to 16 knots. The engines, which are of 1,100 I.H.P., wrought very smoothly, and were much admired by those on board. In point of style and fittings the *Tantallon Castle* is a great advance on any other such steamer on the east coast. The saloon deck is roomy, and has a captain's room and ticket office below the bridge. The saloon is large and beautifully furnished, a ladies' cabin and gentlemen's lavatory are on either side of the entrance, while below there is the dining saloon, at the end of which is a luncheon bar. The steerage accommodation consists of a saloon with a large cabin below, in which there is also a luncheon bar. At the stern of the vessel there is a comfortable quarter-deck well-sheltered by the saloon, which will make a snug retreat when the vessel is going against a head-wind. The saloons and dining-rooms have been beautifully upholstered by Messrs. Paterson, Smith & Innes, Edinburgh. The vessel is fitted throughout with electric light, wrought by Kennedy's new ironclad type, having 650 revolutions per minute, driven by an Archer engine, the attachment being with Dick's patent gutta-percha and canvas belting. The cabin and saloon lamps are in excellent cut-glass globes, while there is a deck lantern with a cluster of lights 20-candle power for use in landing or embarking passengers and baggage at night. Upwards of 40 gentlemen, including Mr. Thomas Aitken, chairman; Mr. Gallway, manager; Messrs. Croall, Kidd, Wallace, Smart, Robertson, Gairn, and Capt. Raison of the L. & E. Shipping Company's new vessel

Meteor, were present at the trial, the invited guests, including Mr. Ramage, of Messrs. Ramage & Ferguson, Capt. Hossack, Rev. Mr. Morris, Mr. W. S. Millar, Mr. Thos. Menzies, &c., all of whom were greatly pleased with the vessel, which reflects the highest credit on her builders, Messrs. S. & H. Morton & Co., Leith, and the Company's superintending engineer, Mr. Young.

Trojan.—On May 28th the *Trojan* went out for her trial trip at Stokes Bay. The Royal Mail steamer *Trojan*, built and engined by Messrs. J. & G. Thomson, of Clydebank, Glasgow, for the Union Steamship Company's Cape of Good Hope mail service, has had her engines converted from the compound to the tri-compound system by Messrs. T. Richardson & Sons, of Hartlepool, and has been supplied with new boilers, working at a pressure of 160 lbs. per square inch. The diameters of the new cylinders are 34, 54, and 89 in. respectively, and the length of the stroke 60 in. She attained a mean speed of 13·9 knots per hour, and indicated 4,092 H.P., her engines working at 66 revolutions per minute, with a steam pressure of 160 lbs. to the square inch. This shows an additional 530 I.H.P., as compared with the *Trojan's* trial trip with the compound engines. The adoption of the triple-expansion engines will add greatly to the comfort of passengers, through the decreased vibration, while the economised consumption of coal will be advantageous to the proprietors. The *Trojan* is the third of the Union Company's mail steamers which has been converted to the new system, and it is confidently anticipated that the result will be as satisfactory as in the case of the two others, viz., *Spartan* and *Athenian*. The *Mexican* is now having her engines tripled, and will be followed on her completion by the *Moor*. The Intercolonial steamers, *Anglian* and *African*, are also fitted with triple-expansion engines.

Australia.—On June 2nd the steel-belted cruiser *Australia*, recently built and engined by Messrs. Robert Napier & Sons, Glasgow, for the British Admiralty, had a preliminary trial of her engines and speed on the Clyde, prior to undergoing her official speed trials in presence of representatives from the Admiralty. On the measured mile at Skelmorlie she attained the very high speed of upwards of 19 knots per hour. As may be remembered, she is a vessel of 5,000 tons displacement, measuring 300 ft. in length, by 56 ft. in breadth, and 37 ft. in depth, and having triple-expansion engines of 8,500 I.H.P. She was launched near the end of last November. Her sister ship, the *Galatea*, which was launched in March of the present year, is now in a very forward condition in respect of her machinery and other equipments.

Taal.—On June 2nd this steamer, which has been built to the order of Don Roxas, for his Manilla coasting trade, had her official speed trials. The contract for this vessel was placed with Messrs. David Rollo & Sons, Fulton Engine Works, and they have fitted her with a set of their well-known three-crank triple-expansion engines, having cylinders 14½, 22, and 38 in. diameter, and a stroke of 27 in. Steam is supplied by a large steel boiler, having three of Brown's patent ribbed furnaces. All the machinery is to Lloyd's requirements for a working pressure of 150 lbs. per square inch. The *Taal* is a vessel 144 ft. long, 22 ft. beam, 9 ft. hold, and carries 200 tons deadweight on a mean draught of 8 ft. The hull was built by Messrs. W. H. Potter & Sons, and as showing the speed with which machinery can be fitted on board, we may state that this vessel was handed over to the engineers at midday on a Monday, and on Friday of the same week she steamed back under her own steam to the builders' yard. The trials yesterday were highly satisfactory, the ship, with 220 tons deadweight on board, doing a mean speed of 11 knots per hour, the engines working up to 112 revolutions per minute with great smoothness. Among those on board during the run were Messrs. Coller, M'Kaig, Fawcett, Potter, Ewing, Rollo, &c.

Grand Riveri.—On June 3rd this steamship, recently launched by the Grangemouth Dockyard Company, went down the Firth of Forth on her official trial trip. On the measured mile she attained a speed of 11½ knots, being half a knot in excess of the guaranteed speed, and which was considered highly satisfactory by the owner, General B. Riveri, of Hayti, who was on board. The vessel will be employed in his coasting service at Hayti and other West Indian Islands.

Crescent.—On June 6th the new steel steamer *Crescent* proceeded from the works of Messrs. Joseph L. Thompson & Sons, Sunderland, on her trial; the vessel having been run over the measured mile at Whitley, when a mean speed of 10·41 knots was obtained. The *Crescent* has been built to the order of Messrs. John H. Barry & Partner, of Whitley, she is of the following registered dimensions, viz:—Length 284 ft., breadth 38 ft., depth 19·3'; of the raised quarter deck type, having long bridge extending to the foremast, and is constructed on the longitudinal stringer and web frame system, thereby dispensing with orlop beams, and is classed 100 A1 at Lloyd's. The engines are of the triple-expansion type, having cylinders 21½ in., 35 in., and 58 in. diameter, with a stroke of 39 in., and have been built by Mr. John Dickinson, of Palmer's Hill Engine Works, and are of about 1,000 I.H.P.; during the trial they worked with the utmost satisfaction. Luncheon was provided in the saloon, the following gentlemen being present viz:—Mr. John H. Barry, Mr. Joseph L. Thompson, Junr, Mr. Wm. Dickinson, Mr. James Dickinson, Mr. Fred Dickinson, Captain Jefferson, Captain Hall, Mr. James Thompson, and Mr. Donovan, superintendent engineers. The success of the *Crescent* having been duly honoured, coupled with the name of Mr. Barry, who suitably replied and requested the company to join him in wishing every success to the firms of Messrs. Thompson and Dickinson, this was the eighth vessel built by the builders to his order and engined by Mr. John Dickinson. He had every confidence of the ship and engines proving satisfactory. Mr. Joseph L. Thompson, and Mr. Wm. Dickinson responded on behalf of their respective firms.

Meteor.—On June 6th the London and Edinburgh Shipping Company's new steamer *Meteor*, built and engined by Messrs. James and George Thomson, Clydebank, had a successful trial trip on the Firth, preparatory to taking up her station to run between Leith and London. The vessel proceeded as far as the Holy Isle and back to Greenock, during which her steaming capabilities were pretty well tested. The *Meteor* is a screw steamer 260 ft. long, 32 ft. broad, and 19 ft. 3 in. deep, with a gross tonnage of 1,220, and built of steel. She is fitted up with all the latest appliances for safety at sea, and accommodation and comfort of passengers, including minute subdivisions of the hull, and every conceivable arrangement for discharge and stowage of cargo. She has also electric light, steam windlass, steering gear, cranes, for rapid working of both ship and cargo. The *Meteor* is built to the highest class at Lloyd's, and is under the command of Captain Raison, the commodore of the fleet. The engines of the new vessels are on the triple-expansion principle, having three cylinders—the high pressure, 29 in. diameter; intermediate, 44 in.; and the low pressure, 70 in., with a stroke of 48 in. Steam is supplied from two steel boilers fitted with corrugated furnaces. How the engines behaved may be gathered from the fact that in the run to the Holy Isle and back, with the ship fully laden, they developed 3,500 H.P., giving a mean speed of 15½ knots, which is equal to about 18 land miles per hour.

Kinshin Maru.—On June 8th the new screw steamer *Kinshin Maru*, built by Messrs. Hawthorn, Leslie & Co., Hebburn, for the Japanese Navigation Company, of Yokohama, went to sea for a trial trip. The dimensions of the vessel are.—Length 376 ft., breadth 35 ft., depth (moulded) 25 ft. She has a deadweight carrying capacity of about 3,050 tons, and is fitted with compound direct-acting engines, built by the North Eastern Marine Engineering Company, Wallsend, having cylinders 32 in. and 62 in., and a stroke of 39 in. After adjusting compasses the vessel went for a series of runs on the measured mile, and realized a speed of nearly 11 knots, the engines working without a hitch, and giving every satisfaction. The Company was represented by Mr. Brown, the managing director, and Mr. Archibald Brown, the inspecting engineer.

Emden.—On June 9th the steamship *Emden*, which has been constructed for the Yorkshire Coal and Steamship Company, Limited, of Goole, by Earle's Shipbuilding and Engineering Company Limited of Hull, was taken on her official trial trip. She is designed to embody all the requirements for the Continental trade as well as the most modern improvements, and her dimensions are as follows:—Length 220 ft., breadth 32 ft., depth 13 ft. 6 in. She is built to Lloyd's highest class for iron and has topgallant forecastle bridge and poop, a considerable portion of the latter being available as shelter for deck cargo and cattle, and water ballast is provided in main and after holes. A comfortable saloon, ladies cabin, and staterooms are fitted amidships under the bridge for 14 passengers, the entrance to which accommodation, together with steering house, are in a house overhead. The Captain's accommodation is on the poop, and the officers are berthed under the poop and crew forward. The vessel is schooner-rigged with two pole masts, and has a very smart appearance. The hatches winches, &c., are carefully arranged to afford the utmost available despatch in working cargo, and she has also powerful steam steering gear of Harrison's make. The engines, which have also been made by the builders, are on the triple-compound three-crank system, and have cylinders 21½ in., 34 in., and 52 in. diameter by

36 in. stroke, supplied with steam of 150 lbs. pressure from a steel boiler of large size. The run on the measured mile off Withernsea proved highly satisfactory; the engines worked smoothly and very well, and the mean speed attained, notwithstanding the strong wind that was blowing abeam, was 13·33 knots.

Mourne.—On June 14th the new iron screw tug steamer *Mourne*, built and engined by Messrs. Edward Finch & Company, Limited, of Chepstow, went down the Bristol Channel on her official trial trip. This vessel has been built to the order of the Carlingford Lough Commissioners, Greenore, Ireland, and her dimensions are as follows:—Length, 92 ft.; breadth, 18 ft.; depth, 8 ft. 6 in.; and classed A1 at Lloyd's for her particular service. Her propelling power consists of a pair of compound surface-condensing engines of 200 I.H.P., embracing every recent improvement applied to engines of this class, steam being supplied by a large steel boiler working at 100 lbs. per square in. pressure. The *Mourne* is fitted with a powerful windlass, driven by a set of three cylinder engines arranged under deck, and capable of lifting weights of five to six tons by means of suitable chain, working over a large sheave fitted in head of stern, and other special arrangements for the performance of her various duties in Greenore harbour. On trial her engines worked with great smoothness, the vessel steaming 9½ knots per hour, which performance gave great satisfaction to Captain Smith, the representative of the Carlingford Lough Commissioners.

Dean.—On June 15th the steel screw steamer *Dean*, recently built and engined by Messrs. Gourlay Brothers & Co., Dundee, to the order of Messrs. George Armitstead & Co., of the same town, had her official trial trip. She is a vessel of 1,330 tons gross register, and measures 244 ft. by 34 ft. by 18 ft. The engines are of the triple-expansion type, and of 900 I.H.P. Messrs. J. D. F. Andrews & Co., Glasgow, have fitted the vessel throughout with electric light. When the speed of the *Dean* was tested between the buoy of Tay and the Bell Rock she attained a rate equal to 13 knots per hour.

Fee Cheu.—On June 18th Messrs. Wm. Doxford & Sons, Sunderland, ran a preliminary trial of the new steel cable steamer *Fee Cheu*, built to the order of James Whittall, Esq., London. The trials were run on the measured mile at Whitley, and were witnessed by Capt. Lugar and officers, and Mr. Sutherland, chief engineer, and assistant engineers, when the running of the machinery gave the greatest satisfaction to all. The maximum speed attained being 13·45 knots, with 98 revolutions, and the mean of the run being 12·8 knots was considered highly satisfactory, the guaranteed speed being 12·5 knots.

Malabar.—The Indian troopship *Malabar* has made a six hours' full-power trial at Portsmouth of the new set of engines with which she has been fitted by Earle's Shipbuilding Company at Hull. The engines are of the triple-expansion kind, and are the largest of the type which have been received in her Majesty's service, and, with one or two exceptions, the largest which have been yet manufactured in this country. In addition to the new engines, the hull has been subjected to a complete overhaul and repaired outside and inside, new fresh water condensers and fire engines of superior size and power being also supplied. The maximum power indicated at the trial was 4,505 horse, but the mean of the entire trial was 4,231, being below the contract. The speed realised was particularly good, reaching close upon 15½ knots, while the consumption of fuel per horse-power per hour was as low as 1·67 lb.

Sinope.—The ironclad *Sinope*, 10,000 tons, was launched on June 1st from the Russian Company's dockyard at Sebastopol.

We are informed that the partnership lately subsisting between Francis Devereux Lambert, the younger, Richard John Lambert, Frederick William Durham, James Dixon Churchill, and William Rudd Oswald, as engineers and manufacturers of Durham and Churchill's Patent Governors at No. 9, East India Chambers, in the City of London, under the firm of Durham, Churchill and Company, was on the 18th day of November, 1883, dissolved by mutual consent so far as regards William Rudd Oswald; and as regards Frederick William Durham the said partnership was dissolved on the 3rd day of June by mutual consent, who on that day retired from the concern. The remaining partners are Francis Devereux Lambert the younger, Richard John Lambert, and James Dixon Churchill. The business will be conducted by Mr. Churchill as heretofore at 23, Leadenhall Street, London.

Correspondence.

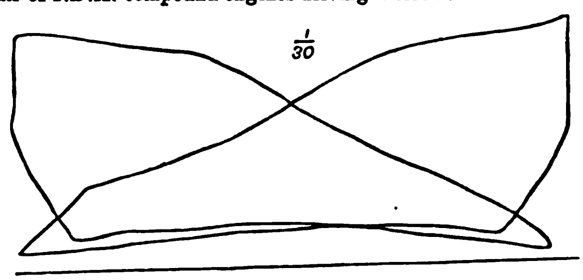
*[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—*Ed. M. E.]

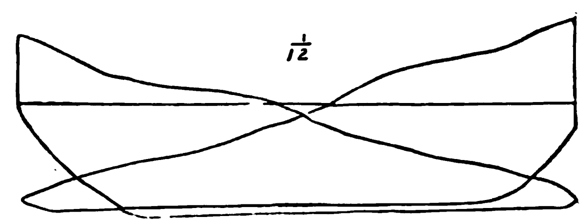
TEMPERATURE AND HORSE-POWER.

To the Editor of The Marine Engineer.

Sir,—I find from your reply to my letter of March last that I had not been sufficiently explicit.

What I should have said was that the diagrams were from a pair of I.D.A. compound engines driving a screw.





Steam 66	Vacuum 23	Revolutions 60
Load 2,480 Tons.	Distance 211 Miles.	Consumption. 13½ Tons.

Range of Temperature. H.P.—76·7 & L.P. 80·7.

Mean Pressures. 30·85 & 8·76.

Indicated Power.
311·819=H.P.
312·553=L.P.
624·372=Total.
·734=Difference.

Since reading your reply advantage was taken of the ship being in Marseilles, to submit the diagrams to a consulting Engineer in that port.

By his advice the H.P. valve was faced up, and as there were four valves beween boilers and piston, two of them were removed.

The travel of L.P. valve was reduced from 7 in. to 5½ in. by fitting a new eccentric sheave.

The results as per enclosed cards are satisfactory.

Are such alterations usual?

Odessa, *May 12th*, 1887. DAVID ROBSON.

[The improved effect you find in the above engine by alteration of travel of L.P. valve can only have arisen from the travel of the valve previously having been badly set out. The refacing of the H.P. valve to reduce leakage, and the removal of intermediate valves which are not necessary, and were thus only obstructive to the free passage of the steam, are obvious improvements, which should have suggested themselves from the badly fitted and arranged system of valves employed on the engine. Hence our former reply to you that such possible improvements must entirely be guided by the exact circumstances and details of each case.—Ed. M.E.]

CERTIFICATED ENGINEERS IN STEAM YACHTS.

To the Editor of THE MARINE ENGINEER.

SIR,—As an engineer engaged on board a steam yacht, I trust you will allow me to contradict, to a certain extent, the remarks made by "W. F. O.," who, in a recent number, says that four years' service in a steam yacht, out of which three years may be spent in harbour, is sufficient to entitle anyone to be examined for a second class certificate. However this may have been some years ago, it is certainly not the rule now, for in several instances that have come under my notice time lying up in harbour and cruising around the British coast has been refused, and in one case time actually spent going from port to port was only allowed; in fact, candidates who now present themselves for examination with yachting credentials find examiners very reluctant to accept them in any form.

It may interest your readers to know that yacht owners are fast waking up to the fact that certificated engineers who have served in the Merchant Service are preferable to men whose "experience" has been gained on board a steam yacht. As witness to this nearly all the large steam yachts at Southampton and Cowes (where there is a fine fleet) carry certificated engineers, who have served in the Merchant Service, not a few of them being men of long and varied experience. Some of the small ones still have their "drivers," but in the majority of cases they are berths which an engineer—if he really is one—would not think of accepting.

If "W. F. O." doubts any of my statements I shall be happy to verify them, and hope, sir, that you will be kind enough to give him my address if it is desired.

YACHT ENGINEER.

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—I have read with pleasure in your last issue the letter of an engineer of a mail ship; I think it the most sensible of all the communications that have appeared in your journal on the burning question, "The Position of Marine Engineers." The old saying, "Heaven helps those that help themselves," will apply in our case as in others. I think a little plain speaking on this matter would be beneficial, so that we may "see ourselves as others see us." As no combination will enforce respect unless we ourselves show the owners we are thoroughly conversant with the duties we undertake to perform, and discard the ideas and notions that have grown up with us in the shops. There are many engineers, I am sorry to say, cannot or will not do this, their aim being to get their watches over and retire to their berths, or should they be required to do any work when it is their "watch below," it is done with a bad grace. There is nothing in our avocation to prevent us always conducting ourselves as gentlemen; true, we are not always as clean as the other officers of the ship, there is great room for improvement here, but this need not be a detriment if our behaviour is otherwise irreproachable.

I think with your correspondent that, instead of forming a sort of trades union which I notice is in contemplation, if we were to combine for mutual improvement, and have papers read by members on subjects of interest to our profession, we would sooner attain our object and command the respect of our employers, and let me add this will be a work of no small difficulty, there being deep-rooted prejudices to efface, not all due to ourselves, but with some owners we are looked upon as a necessary evil.

I am glad to bear testimony to the very great strides made by our profession in the last ten or fifteen years, and if we wish to hold our own we must advance with the spirit that is abroad to-day in the engineering world, every year adding to our responsibility. The men who will not move out of the grove they have been trained in must make way for other and more progressive spirits.

I would just add there have been several unions among marine engineers formed, but they have only had an ephemeral existence, the nature of our calling rendering it neccessary that the business should be conducted by some of our retired brethren, and they are not always in the best position to make their or our influence felt. But I and others seeing the necessity of something higher and nobler than a mere union for aggressive purposes, would welcome the formation of an institute such as your correspondent suggests. S.

SUNDERLAND, *June 8th*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—When referring to the controversy between "Excelsior" and "An Uneducated Engineer," my intention was to adopt a conciliatory tone, and in doing so I said I thought "An Uneducated Engineer" *might have let "Excelsior" down a little more easily.* This expression was used as more appropriate to a free-and-easy style of writing than its equivalent in strictly classical English would have been, and I felt assured my brother readers would understand its meaning, and appreciate my motive in using it. I regret to find, however, that "Excelsior" has not read my remarks in the spirit in which they were written. He has viewed them in a harsh critical light; he has interpreted them to suit himself; and, while charging me with several offences I did not commit, he has improved the occasion by displaying his skill in satirical writing, a style that will neither conciliate his opponents nor further the cause he professes to advocate. My principal objects in taking part in this correspondence are to assure my brother engineers that there is at last a prospect of emancipation from that slavery we have so long endured, and to point out, as well as I can, how this is to be accomplished; and I trust that in doing so I shall never so far forget myself as to abuse your kindness—in opening these columns so generously for our use—by descending to personalities, or sneering at the earnest efforts of my fellow-contributors.

'Tis refreshing to turn to the solid, practical advice contained in the letter by "Engineer of a Mailship," coinciding, as it does, with the sentiments of those by whom the Union was founded in almost every detail. Knowing its author now as a much respected chief engineer in the mail service, who has become a member—and a very enthusiastic one—of the Union since his letter was printed, it would not become me to say more regarding it than that it can be recommended for perusal by those engineers who have not already seen it, as a display of that spirit that ought to pervade our whole ranks, and an example of pride in our profession well worthy of imitation. As you have already learned from our brief interview on the railway platform at Liverpool the other week, the branches of the Union at Cardiff and Liverpool had just then been formally opened, and as soon as the committees there have fairly settled down to work, there is every prospect that each of these ports will provide a large contingent of members. Since then *interim* appointments have been made, and work fairly commenced in both Hamburg and Hull, and, as in both places our fellow-workers are not only leading men, but both able and energetic, we expect soon to have good news from both these districts.

The general membership is steadily increasing through the personal efforts of our members alone, and numbers of the very best men are sending in their applications, including chiefs from nearly all the leading mail and other steamship companies, both at home and abroad.

To encourage us in our efforts, and cheer us on our way, our brethren of the Australasian Institution of Marine Engineers have sent us, through their general secretary, a very long, kind, brotherly letter, and copies of all their reports and publications, giving us the results of their experience and some sound advice as to our future proceedings, which but adds to the burden of our indebtedness to them for having already shown us the way, and what even a small body of our brethren can do when they choose to make an effort in the right direction—but of this more again. Thanking you for your continued kindness,

I remain, yours very truly,

THE HONORARY CHIEF SECRETARY,

Marine Engineers' Union.

91, MINORIES, LONDON, 23*rd June*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—With regard to the correspondence now being conducted through the medium of your pages in *re* Mates *v.* Engineers, it is much to be regretted that the general tone pervading your correspondents' letters should be what it is; and as an engineer of thirteen years' seagoing experience I should feel obliged if you would allow me to pour, metaphorically, oil and sulphur upon the heated bearings of your correspondents' imaginations. They—the writers of these letters—appear to be able to put their literary effusions together, and otherwise show every indication of perfect sanity, till the words deck-officer or mate floats across their fevered mental vision, which immediately induces what is apparently a species of hydrophobia. Even the Honorary Chief Secretary, who, by his

position as head of what promises to be some day an important association, joins in the cry with a zest which would make one think that he had been at some period in his career badly sat upon by some member of the deck fraternity, and was still suffering.

He says that application is being made to Parliament for powers to enable engineers to pass in navigation. Does anyone in his sober senses suppose that their—I should say our—position will be improved thereby. Shall we get higher pay or shorter hours? Would it not be more than likely that we should have to tally cargo and otherwise mix ourselves up in things which do not at present concern us? Thank goodness, may they never! I have had to keep a watch on the bridge after my four hours below, and thank you kindly, Mr. Honorary Secretary, but I have no wish to repeat it, or qualify myself for it, to the exclusion of my own proper business, which, in my humble opinion, it takes a lifetime to learn—no less. And if we devote time to learning navigation and such nonsense, so much the less chance of being perfect in our own profession. Navigation is, and should be, carried on by a set of men properly qualified for the job, and it ill becomes us, as followers of the noblest profession, and wielders of the greatest power on earth, to endeavour to cut the ground from under the feet of a set of men who, whatever their faults, have at least as much right to live as we have, and though they have a weakness for the donkey in the mornings, when, perhaps, steam is hard to get, still, short-handed as our ships always are, how would they ever get the decks done without it. Their hours of labour are longer; their pay and prospects far worse than ours; and yet we must needs meddle with their affairs. *They* are allowed to pass in steam, an examination which most of them appreciate at its true value by ignoring altogether. The old law that a little knowledge is a dangerous thing is never better illustrated than by captains who have so qualified, who will tell their chief engineer more things in a forenoon than he or John Bourne, of respected memory, ever knew; and I venture to predict that very few engineers will avail themselves of the opportunity of passing in navigation, unless shipowners offer some inducement to them to do so—which is scarcely lik·ly.

In my present ship, deck and engine room agree capitally together, and I should be sorry to see anything occur to spoil the friendly feeling which pervades both arms of the service on board. Long may it continue, but letters like those of your correspondents are not likely to make things smooth afloat, but rather the reverse, and would give young engineers the impression that the deck officials were to be sat upon at every opportunity for the credit of our cloth, instead of shipmates sharing with the toils and dangers of sea life, with whom it is to our interest to live as comfortably as we can. For is it not written, "From envy, hatred, and malice, and all uncharitableness, good Lord deliver us."

Let us remember also that we, together with our boilers and engines, will not last for ever, but will be supplanted and sent to the wall in course of time, for behind us looms the electrician, who is already beginning to make himself felt, and who will inevitably shoulder us out presently, even as your correspondents say we are shouldering the mates. Though if it is so, it is due, not to any merit on our part or demerit on theirs, but simply to the force of circumstances and march of progress.

Truly yours,
ROBERT FREDERICK TAPLIN.

Liverpool, June 20th, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—It is satisfactory to read that the British pilots have so far landed their clause in the Merchant Shipping Act Amendment Bill to protect Trinity House pilots against foreign labour that we may hope the clause will not be strangled.

It is still more cheering to read the [respected] courteous Hon. Chief Secretary's statement that a like proposition is already engaging the attention of his executive for protection of the British Board of Trade certificated marine engineers in British waters *against foreigners enjoying privileges British subjects solely should enjoy*. It is to be desired that when the executive deem it prudent to move for the clause, the present ministry will be in power, and the Secretary of the Board of Trade in the Salisbury Administration will stand by us and support us.

"Excelsior" does not disguise his dislike to the word "union," yet he need not deny to others (however much he is smarting from packing-stick of "South Shields") that liberty of opinion on this and other subjects which he claims for himself. Fancy such a [cantankerous] fellow officer in an engineers' mess! He quotes proverbs to others, forgetting another proverb runs, "Seest thou a man wise in his own conceit? There is more hope of a fool than of him." The seagoing marine engineers of the present day must be workers, not dreamers. It is the knowledge of facts, the result of experience, and not theories and hypotheses which tend to or call forth wisdom. Some man wrote, "Common sense, in spite of schoolmasters and philosophers, is the best of sense;" and seagoing certificated marine engineers, rule of thumb, hammer and chisel men, who have worked under British and other flags, and still found time to digest Burgh, Rigg, Pray, Uhland, Tolhausen, Shock, Steam Motors and Saturated Steam, Rigault, are fully aware of the additional element of danger resulting from orders given by "theoretical, inorganic chemistry, hydrostatics, hydrodynamics chiefs," however competent they may be to describe the products of the combustion of a candle, indicating how their existence may be shown and their weight found experimentally, and why they together weigh more than the candle, or that it has been found that water, under a pressure of 50 atmospheres, marks 510° by the thermometer, or that by allowing a small jet of steam to pass into our fires we shall prevent smoke by causing it to be consumed, increase the heat, and save 33 per cent. of fuel. The working seagoing engineers are quite alive to the absurdity of putting such a class of book-in-breeches to direct the working in a steamship of marine engineers of the present day, and it is with this view, in the interests of our professional brotherhood, "touch" should be kept, ignoring to our very utmost superfluities, or holding out a premium for theory to oust out practice.

The day has gone, "Solomon Excelsior," for the chanticleer who crow'd "When I speak let all men hold their peace." We must all bear and forbear, brother. You can enjoy your valueless opinion of me and my grammar as freely as I express mine of your spurious proposition and worse French. Your intention may be good, fellow-worker, and, whether you are aged 20 or 60, possibly, after you have got rid of your deficiencies and indiscretions, by association with true seagoing marine engineers, you may acquire intellect sufficient to *understand* what "South Shields" letter, "Propeller's," and my own imply; then, and then only, your bilious propensity will become moderated, your language courteous, and you will vacate your present unenviable position of "L'Ane dans le peau du Lion."

I beg, Mr. Editor, you will believe I am sensible of the great kindness and consideration you have extended to me. In any matter which can advance the interest of MARINE ENGINEER, or the glorious profession to which we have the honour to belong, I hope never to be found wanting.

I am, Sir, yours truly,
RICHARD A. JAMES COPE,
Working Marine Engineer, No. 20,517,
Decorated Order of Leopold, 2nd Class.

SAS-LEE OSTENDE (BELGIUM), *8th June*, 1887.

Reviews.

An Introduction to Machine Drawing and Design. By D. A. LOW. London: Longmans, Green, & Co.

PROBABLY no one appreciates a good drawing more than an engineer, yet how few engineers are there who can turn out a creditable drawing. This, we take it, is not due so much to lack of interest on their part as to the unsatisfactory system, or might we not say lack of that system, that generally prevails with drawing masters, and to the want of a good elementary manual on the subject. Mr. Low's work supplies everything that could be desired in a text-book for the student in machine drawing and designing, and that too in a *thorough* and practical manner, but we fear that it will take many years to thoroughly eradicate the mischief done by that class of teacher who, at best, should only be called mere copyists and not masters. In this work the author has aimed at placing before engineers and others who wish to acquire the skill and knowledge necessary for making the simpler *working drawings* such as are produced in engineer's drawing offices, a number of good exercises in drawing, and at the same time a corresponding amount of information on the design of machine details generally. The illustrations are all new and have

been specially prepared by the author from working drawings representing typically the best modern practice. To show that Mr. Low is no advocate of mere copying we will briefly enumerate the method of teaching adopted. In the first and simplest exercise certain views of some machine detail are given, generally drawn to a small scale, which the student is to reproduce to dimensions marked on the views, and he is expected to keep to these dimensions only, and not to measure anything from the illustrations themselves. In the second exercise the student is asked to reproduce certain views to dimensions given in words or tabular form, while in the third exercise he is required to make, in addition to certain views shown to given dimensions, others which he can only draw correctly if he thoroughly understands the design before him; while finally he is asked to make the necessary working drawings for some part of a machine which has been previously described and illustrated, the dimensions to be calculated from rules given in the text. There is much useful information on drawing boards, instruments, colours, etc., and the minor parts of a draughtsman's work, and a very interesting chapter on "Materials used in Machine Construction" winds up a book, the principles of which are sound, and whose teaching is thorough. The price, 2s. 6d., places it within the reach of all, and even those "who can turn out a creditable drawing" will find themselves benefited by a careful perusal of it.

The Practical Engineer's Handbook. By W. S. Hutton. London: Crosby, Lockwood & Co.

A book by the author of the well-known "Works' Manager's Handbook" is sure to command attention, and Mr. Hutton's present work is in every respect well worthy of attention from all interested in engineering matters. To attempt a mere mention of all the subjects treated of would be a task beyond our limited space, and it must therefore suffice to say that everything appertaining to the following broad headings is well, amply, and lucidly gone into in the pages of this eminently practical handbook. Section I. deals with air, wind, and wind motors; water and water motors; heat and fuel; gas and gas engines; combustion, &c. Section II. treats exhaustively of the whole subject of evaporation; boiler shells, boiler furnace tubes; Board of Trade, Lloyd's, and other rules and data for steam boilers; boiler construction; boiler explosions. Section III. is devoted to steam, condensation, condensers, air pumps, water pumps; slide valves, piston valves, corliss and other valves; link motion and other valve gear. Section IV. embraces all that is at present known about connecting rods, coupling rods, crank shafts, crank axles; screw propeller shafting and bearings, screw propellers, paddle wheels, and jet propellers. Section V. will probably find most favour with marine engineers treating as it does of horse-power; expansion of steam in the cylinder; proportions of the cylinders of steam engines; pistons, piston rods, and crossheads; mill engines; double-expansion, triple-expansion and quadruple-expansion marine engines. Section VI and final section refers exclusively to the constructional department, and gives at length the strength and specific gravity of steel and wrought iron plates and bars; cast iron, gun metal, brass and other alloys; timber and other materials, and a host of other useful information. As showing how fully the author has gone into the subjects comprised under the various headings, we may state that he has called to his aid no less than 371 illustrations to elucidate and shorten the description of the various parts. And here we should state that the illustrations throughout the work are admirable, and while showing, even in the most complex examples, a due regard for detail, evince a boldness of style and clearness of finish showing at once that the drawings from which they were prepared were the work of accomplished draughtsmen. By pen and pencil thus combined (if we may be allowed to use the expression), Mr. Hutton has succeeded in getting into 456 pages more useful, recent, and practical information, and that, too, given in simple language and in a concise and condensed form, explanatory of the true principles of, and giving the principal rules for, the construction of engines and boilers, and the economical production of steam power, than has ever yet been brought under our notice in any one single volume. A work of this description is too wide in its scope to warrant us in recommending it to any particular class of engineers, but to those of our readers who want a thoroughly good all round practical handbook we cordially commend it, because we are sure that no engineer can go through it without learning something that will be of service to him. Numerous rules and practical data are given for triple and quadruple expansion engines, and an excellent photograph of a set of 1,200 I.H.P. triple-expansion engines forms a neat and appropriate frontispiece to a work dealing with the latest phases of engineering science. The book is carefully printed on good paper, of a handy size for reading, and is well and serviceably bound.

Messrs. Cochran & Co.'s Illustrated Catalogue.

We have now before us a neatly got up, to quote the full title, "Illustrated Catalogue of Launches, Yachts, Tugs, Small Cargo Steamers and Barges, Machinery for Small Vessels, High Pressure Non-Condensing, Compound Non-Condensing, Compound Surface-Condensing, Triple-Expansion Surface-Condensing," as manufactured by those well-known builders, Messrs. Cochran & Co., of Birkenhead. The catalogue contains numerous illustrations typical of the various kinds of craft and machinery as built by this firm, together with the leading dimensions and prices of the most usual sizes. The numerous types of vessel built by this firm, together with the high class of workmanship and material for which they are famous, have gained for them a name which we need not dilate upon; suffice it to say that the illustrations given in the present catalogue, both of vessels and machinery, show a due regard for symmetry of design combined with strength in all the parts, and he would indeed be a fastidious buyer who did not find amongst the numerous examples given a vessel to suit his requirements, be the same launch, yacht, tug, barge, or cargo boat. We notice, amongst other specialities of the firm, designs for steam barges, of which we believe they have sent numbers abroad.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from May 20th to June 9th, 1887.

7006 O. E. Pohl. Propellers.
7022 E. Lightowler. Breakwaters, &c.
7060 F. Jordan. Self-discharging sewage barge.
7122 A. J. Cooper & E. E. Wagzell. Taking soundings.
7129 T. Johnson. Serving ropes for ships' rigging.
7132 J. Michel. Speed indicator for vessels.
7142 C. Henderson. Collapsible boats.
7168 H. Swindall. Life-saving equipments.
7172 Wether (J. B. Little). Water level indicators for steam boilers.
7215 D. J. Morgan. Indicating ships' light.
7220 W. W. Reversing gear of steams.
7266 J. Rogerson, A. Downie, & J. A. Snowdon. Watertight doors for ships.
7340 J. Neff. Motive power.
7383 C. Henderson. Ships' boats.
7402 J. Smith & D. Cowan. Steam generators.
7420 A. McInnes. Forced combustion in furnaces.
7437 J. G. G. E. Bischoff. Lubricators.
7469 Capito (P. K. Prytz & S. A. Rung). Ship logs and current-meters.
7478 W. Shearman & J. G. Galley. Closing ships' bulkhead doors.
7497 H. Lyon. Increasing the speed of screw steamers.
7498 W. Bury. Screw propellers.
7521 J. A. Wade & J. Langdon. Rotary engine.
7585 F. Gregson. Life preservers or buoys.
7611 W. C. Johnson & S. E. Phillips. Submarine cable grapnels.
7622 Knight (A. A. Goubert). Feed water heaters and purifiers.
7640 R. Robson. Grate bar for steam boiler and other furnaces.
7653 J. H. Dewhurst. Steam engine governor.
7654 T. T. Kemp. Rotary engine.
7658 T. W. Baker. Valves and steam traps.
7672 F. J. Crossley. Propeller blades.
7675 W. C. Johnson & S. E. Phillips. Mushroom anchors.
7693 J. L. Garsed. Lubricators.
7705 J. H. O'Connor. Ship's bottoms.
7716 P. Evans. Steam generators.
7717 J. C. Stitt. Steam generators.
7719 Bromhead (C. Rohn). Piston packing.
7729 C. H. Benton. High speed steam engines.

7742 E. P. Lereche. Torpedo exploding apparatus.
7756 Lake (B. Roberts). Steam boiler furnace smoke condenser.
7770 L. J. Wing & T. A. Richards. Oscillating steam engines.
7772 G. W. Allen & H. J. A. Bowers. Steam b iler water purifier.
7814 E. Palmer. Bricks and fire bridges for steam boiler furnaces.
7815 T. Taylor. Steam boilers for consuming smoke.
7828 G. H. & A. L. Lloyd & H. Bewley. Boiler flues.
7833 J. S. Fairfax. Boilers, flues, and furnaces.
7840 J. B. Pegden. Steering ships.
7842 A. Taylor. Marine night signals.
7866 G. Chapman. Steering vessels.
7893 W. Huett. Screw propellers.
7901 J. McK. Chase. Steam boilers or generators.
7910 J. R. Robson. Boilers.
7914 R. Rood. Registering speed of vessels.
7935 M. N. Ridley & G. F. Blackmore. Landing stages, &c.
7938 T. Hipkins. Steam boilers.
7940 J. T. Williamson. Loading of heavy guns.
7947 A. C. Boothby. Moveable stern dock for screw steamers.
7948 A. C. Boothby. Cleaning ships' bottoms.
7963 C. Dunkin & B. G. Nichol. Steam steering apparatus.
8006 R. Holdsworth. Marine sounding apparatus.
8018 G. A. de Penning. Rotary st am engine.
8050 A. J. Marquand. Prevention corrosion, &c., in boilers.
8051 J. S. Wyndham. Cushioning valve for pumps.
8052 A. Noble, C.B. & C. H. Murray. Disappearing gun carriages.
8057 J. M. McCullock. Link motion for valves.
8065 W. Jones. Circular fleet of sailing ships.
8073 J. Noble. Boiler tube stoppers.
8079 E. Klein. Steam regulator.
8080 Talman (C. G. Blackburn). Protecting ships.
8097 A. Tolhurst & H. Skinner. Slide valve mechanism.
8104 E. Lightowler. Retaining tidal waters.
8110 L. P. Cohen & E. Herrmann. Steam boiler furnaces.
8113 H. Davey. Pumping engines.
8116 T. Moy. Fluid pressure engines.
8118 W. Balch & F. Hargrave. Disengaging tow ropes, boats, &c.
8124 H. P. Parkes & J. Hartness. Anchors.
8151 A. Fehlen. Vapour engine.
8159 W. Smith. Communicating to or from vessels.
8172 W. Ambler & W. O. Blackburn. Steam boilers.
8179 J. Thiry & G. Chantrenne. Loiron steam injectors.
8180 W. H. Farris. Steam generators, &c.
8182 Johnson (A. Ciurcu). Propelling by reaction,
8184 C. Henderson. Ships' seats and shelters.
8195 G. F. Lütticke. Propelling boats, &c.
8197 Newton (W. Craig). Condensers.
8204 P. Haenlein. Propelling vessels.
8226 R. Scott. Steam boilers.
8228 C. A. Knight (The Babcock & Wilcox Co.). Steam generators, &c.
8268 J. A. Timmis. Sea connections on ships.
8270 Abel (P. Brennicke). Valves and valve gear.
8272 F. P. Warren. Saving life at sea.
8294 Fr. O. Larsen. Pouring oil on waves.
8304 S. Hughes. Life boats or life boat deck seats.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

May 21st. Nisbet, J. M. Extra 1 C Leith.
June 18th. Field, Thos. Extra 1 C Leith.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

May 14th, 1887.

Benton, Jas. A... 2C N.Shields
Bird, Thos. ...... 1C ,,
Bradley, Jas. K. 2C Leith
Drummond, David 1C ,,
Ford, Wm. F. .. 1C ,,
Gibson, Andrew . 2C Liverpool
Gold, Jas....... 1C N.Shields
Grant, Alex. D. , 2C Greenock
Harley, Wm. .. 2C Leith
Hunter, Thos. .. 1C N.Shields
John, Thos. M. .. 2C London
Lake, Chas. R. .. 2C ,,
Legg, John Thos. 2C N.Shields
Low, Peter .... 1C Leith
Lyons, Vincent.. 1C ,,
McEwen, Donald 1C ,,
Morley, Thos. .. 2C N.Shields
Neil, Wm........ 2C Leith
Pollen, John .... 1C Dublin
Roberts, E. .... 2C Liverpool
Roberts, P. ...... 1C ,,
Taylor, Alex...... 2C Leith
Vincent, Geo. L. 2C Plymouth
Walker, John G. 1C N.Shields
Whyte, John.... 2C Leith
Wright, Francis J. 2C Hull

May 21st, 1887.

Adam, Robert .. 1C W. H'pl.
Bell, Thomas.... 1C N. Shields
Black, John C. .. 1C Liverpool
Blair, Robt. .... 2C ,,
Boughten, R. J.. 1C Cardiff
Burnett, Joseph 2C W. H'pl.
Cowan, Wm...... 1C Glasgow
Dallas, James .. 2C Liverpool
Davies, Ed. M .. 1C Cardiff
Davison, John W 1C London
Dickson, Wm. M. 2C Glasgow
Dunn, Peter .... 2C Sunderl'd
Findlay, Thos. .. 1C Glasgow
Grant, Chas...... 2C Cardiff
Griffiths, Henry 1C ,,
Hall, Jefferson M 2C N.Shields
Hall, John J. .. 1C Sunderl'd
Hunter, John R. 2C ,,
Hodgson, Wm.A. 2C Cardiff
Isaac, Wm. .... 1C ,,
Jack, Wm....... 2C N.Shields
Kellett, Robt. M. 1C Sunderl'd
Kelly, John .... 2C Glasgow
Laisson, Albert F 1C Sunderl'd
Lindsay, Jas. .. 1C W. H'p'l
McGregor, W. G. 1C Liverpool
Mitchell, John .. 1C ,,
Morgan, Edw. H. 1C ,,
Pearcy, W. H. .. 2C Sunderl'd
Ramsey, Chas. .. 2C Cardiff
Renton, James .. 1C ,,
Robertson, John B. 1C Dundee
Rule, John .... 2C Glasgow
Stewart, Arch. .. 1C ,,
Storey, George .. 2C Sunderl'd
Tobias, John E... 2C Cardiff
Vasey, William .. 2C W. H'p'l
Waters, Ch. H.T. 2C ,,
Whaley, Henry A. 1C N.Shields
Wyndham, Steph. 1C Cardiff

May 28th, 1887.

Embleton, Martin 2C N. Shields
Kingston, John .. 2C Hull
Rothery, Joseph.. 1C ,,
Seddon, Joseph .. 2C ,,
Yaxley, John D. 2C London

June 4th, 1887.

Anderson, H. .. 2C Glasgow
Anderson, A. G.. 2C Liverpool
Atkinson, John .. 1C ,,
Bethell, Edwin .. 1C London
Bloor, Wm........ 2C Belfast
Bulloch, A........ 1C Glasgow
Casebourne, C. B. 1C London
Craig, Robert .. 2C Belfast
Davies, John .... 2C Liverpool
Gates, L. J. .... 2C London
Hill, John ...... 1C Glasgow
Mackie, John.... 1C ,,
McGregor Duncan 2C Liverpool
Monteagle, J. A. 1C Glasgow
Monteith, John .. 1C ,,
O'Neill, Edward.. 1C Liverpool
Radford, E. R. .. 2C London
Rawl, R. W..... 1C ,,
Smith, J. W..... 2C ,,
Tate, A.......... 2C N.Shields
Watt, John....... 2C Liverpool
White, John .... 1C Glasgow
Williams, D. R... 2C Liverpool
Williamson, W... 2C Glasgow
Winter, James .. 1C Liverpool
Young, David .. 1C Glasgow

June 11th, 1887.

Allan, James .... 2C Greenock
Anderson, Robt.G. 1C Leith
Appleby, Wm. .. 1C London
Boulding, R. J... 1C Leith
Dick, John B. .. 1C London
Ferens, Frank S. . 2C N.Shields
Hamilton, W. D. 1C Liverpool
Hargreaves, Wm. 2C Greenock
Howell, W. H. .. 1C London
Johnson, L. .... 1C Liverpool
Laing, Alex. .... 1C N.Shields
Lester, James.... 2C Leith
McConaig Alex... 2C Greenock
Mitchell, A. .... 2C London
Mudie, David.... 1C Leith
Murphy, Patrick 2C Greenock
Paterson, Wm. .. 1C Leith
Paul, Arthur H. . 1C London
Peacock, Andrew 2C N.Shields
Ring, John L.... 2C Leith
Robbie, Charles.. 1C ,,
Scott, Anthony .. 2C N.Shields
Smith, David .... 2C Leith
Steel, John F.... 1C London
Steven, John .... 2C Leith
Stoker, John T... 1C N.Shields
Swenson, C. A. .. 2C London
Watson, Joseph.. 2C N.Shields
Wilkie, James .. 1C Liverpool
Wylie, J........ 2C Leith

June 18th, 1887.

Belford, David .. 2C N.Shields
Bennie, James .. 2C Greenock
Collings, E. W... 2C Liverpool
Cook, Thomas .. 2C Cardiff
Currie, Arch..... 2C Glasgow
Curtis, Chas. W. . 1C N.Shields
Drew, John .... 2C Cardiff
Eager, John .... 1C ,,
Elder, James .... 2C Glasgow
Ewing, R. G..... 1C ,,
Gibson, John .... 1C Cardiff
Hall, John C. .... 2C N.Shields
Jackson, Peter .. 1C Glasgow
James, H. G..... 2C Cardiff
Jefferies, Ed. B... 1C ,,
Keith, David .... 2C Glasgow
Kistner, Frank .. 2C Cardiff
Macbridge, J. S.. 2C Glasgow
Mackie, Andrew . 1C London
McMillan, Donald 2C Glasgow
McRae, Alex. .. 1C ,,
Mitchell, Robert.. 2C Plym'th
Morris, David.... 1C Cardiff
Oliver, William.. 2C Glasgow
Owen, F. E. .... 1C Cardiff
Pietsch, Alex. .. 1C London
Reid, William .. 1C Dublin
Robertson, Robt.. 2C London
Scurr, Thos. F... 1C W. H'pl.
Simpson, W. F... 1C Liverpool
Smith, John .... 2C W. H'pl.
Stephen, D. W... 1C Dundee
Stoddart, Joshua. 2C W. H'pl.
Thomas, W. R... 1C London
Thornber, W. A. 2C Liverpool
Tilston, H. E. .. 2C London
Trevor, T. W. .. 1C W. H'pl.
Walls, J. C. .... 2C London
Weir, W. H. .... 2C Glasgow

The Marine Engineer.

LONDON, AUGUST 1, 1887.

EDITORIAL NOTES.

THE improvement in modern marine engineering has tended very largely to an increase in boiler pressure, and with triple-expansion engines the tendency is still to an increase of boiler pressure to obtain the maximum ranges of expansion. It is difficult to imagine to what extent this can increase before a limit is arrived at. The shells of boilers may probably be indefinitely strengthened, without any difficulty, to carry very high pressures, much higher than anything that has been done up to the present. With the flues, however, there will be more difficulty in obtaining ample strength at high pressures. With plain flues of usual diameter to give sufficient room for the firegrate, a limit is probably reached at about 100 lbs. per square inch, with a suitable factor for safety. The reason for this limit is that after a thickness of half-inch plate has been used, any increase of metal is so apt to lead to over heating that any practical increase of strength by the use of thicker plates is very questionable. The corrugation of flues, or the working of them up with a spiral corrugation, has served to increase very largely the strength of large flues, without undue increase of metal, and, therefore, to raise the possible limit of practical working pressure from say, 100 lbs. per square inch to at least 250 lbs. After that point it becomes an open question as to how flues of practicable dimensions, to contain grates say of about three feet in diameter, can be sufficiently strengthened to carry steam pressures higher than that indicated. We have found, however, that there is some diversity of opinion as to the ultimate thickness of metal at which overheating is liable to take place, by reason of such excessive thickness. We have spoken of half-inch thickness as being possibly the practical limit for flue plates, but we have heard on good authority that there is no real obstacle in using flue plates up to three-quarters of an inch thick if necessary. We should be glad to hear from any of our readers who may have had experience in the working of thick flue plates or tubes, as to how they found such plates stand the fire, and whether there was a marked loss or waste by overheating.

WE gave some attention in a prior issue to the note of certain disasters which had overtaken torpedo boats when running a trial test, and in which serious breakdowns of the boilers occurred, chiefly through collapse of the fire boxes. Much discussion has since arisen as to the particular details which may have caused such collapse, and a considerable amount of variation of opinion appears to exist on the subject. It is a remarkable thing that nobody seems to know in those instances whether the crowns of the fire boxes were actually overheated or not. There appears to have been no fusible plugs in the crown of the fire boxes that might have given due warning of the crowns being laid bare, and thus of impending danger. It is difficult to realize how high pressure boilers, under such circumstances, could have been without these necessary and elementary details of protection. We think it is quite likely that, instead of arising from mere fault of detail, the collapse may have been altogether due to neglect on the stoker's part, and consequent overheating. In any case we hope that the serious disasters referred to may occasion such radical alteration in the design of boilers for torpedo boat purposes that they may be rendered more reliable in ordinary work, and with better guarantee against such serious disasters. We think it remarkable that the flat topped fire boxes should have remained an approved form of engineering construction for so long a period. This form is essentially faulty in design, as no surface is so likely to collapse as a flat surface, and necessarily requires excessive staying to support anything like an ordinary boiler pressure. As other forms of construction have been successfully adapted to locomotive use, such, for instance, as corrugated arched roofs to the fire boxes, we should be glad to see some such change adapted to torpedo boat work.

WE are glad to see that the importance of engineer officers in the navy, as essential to the good working and even fighting of our modern navy, is becoming gradually more generally recognized. We see that it has been arranged that classes for marine engineers are to be formed four times in each year on board H.M.S. *Excellent*, at Portsmouth, for the purpose of instruction in the hydraulic machinery for heavy guns. The modern heavy ordnance is of a costly and extensive character, and is now entirely beyond the capabilities of manual power. Steam power, therefore, is first relied upon to produce the necessary hydraulic pressure, and the whole of the manœuvring and operation of the modern heavy guns now depend upon the most delicate and complex hydraulic machinery. The proper use of these machines still lies in the hands of the gunnery officers, whose duty it is to direct and drill the ships' crews, though we think that even here the operation of the machinery would be more

intelligently directed by officers having a proper knowledge of engineering than by mere seamen. The proper efficiency and repair of these machines further lies in the hands of the engineer officers, and it is of course well that these officers should be thoroughly acquainted with the exact details of any machinery they may be called upon to keep in order. We trust that the superintendence and direction of these classes will, at any rate, be confided to the hands of a responsible engineer, and not to that of a gunnery officer, as has often hitherto been the case in similar instances. Such a relative position between engineers and seamen is absurd in itself, and an unnecessary indignity to the engineers. It would be quite as reasonable were the gunnery or naval officers to undertake to instruct the surgeons on board ship; nor can we think that such an anomalous position can be pleasant to the gunnery officer himself, where he must feel that he is dealing with subjects in which his students are essentially more expert than himself. Any engineer worth the name must essentially have a good practical knowledge of hydraulics and hydraulic machines, without absolutely having been brought into contact with any specific set of devices, and we would undertake to say that a hydraulic engineer, without knowing the particular machines to which his attention was directed, could find much from his general knowledge on which to instruct any amateur or sea-going officer who was merely acquainted with the use of the said machines, without knowing the details of their construction. If all sea-going officers are willing to become engineers, the naval engineers cannot grumble to receive their orders and instructions from them, but until that qualification is arrived at the naval engineers may still justly agitate for a more equal recognition of their professional position as compared with that of the naval officers.

New American Yacht.—The *Volunteer*, the new yacht built to sail against the *Thistle*, was launched at New York on Thursday, June 30th. The accounts say that she is unlike any yacht heretofore met with in American waters, and that a more rakish, piratical-looking craft was never seen. She looks in the water like a floating sword-fish. She is full in the body but fine at the ends, and keen at the prow as a razor. She is 107 ft. over all, but only 86 ft. on the water line. Her most striking features seen on a broadside view are great depth aft, long, keen, sharply diminishing forefoot, cutter-like rake of sternpost, long angular overhang, and sharp sheer fore and aft. While the new boat is 7 ft. longer than the *Mayflower* over all, she is only one foot longer on the water line, has 3 in. less beam, 6 in. more draught and carries 20 tons of ballast. Strictly speaking she carries no outside ballast, as none is below the keel, but her keel consists of steel plates, three-quarters of an inch thick, curved upward into a trough-like shape, and into that 50 tons of melted lead have been poured. Besides that she will carry 20 tons of pig lead as movable ballast to regulate her trim. Her dimensions are as follows:—Length over all, 107 ft.; on the water line, 86 ft.; extreme beam, 23½ ft.; extreme draught, 10 ft.; outside ballast, 50 tons; inside ballast, 20 tons.

SUBMARINE WAR-BOATS.

(*Continued from page* 117.)

FIVE of the most recent kinds of submarine boats, are said to mark a new epoch in submarine warfare. One of these, invented by Mr. Nordenfeldt is 64 ft. long, and has three propellers, one aft, which is driven by an ordinary marine engine, and one on either side. The latter are required for causing the boat to descend when the margin of flotation had been removed by filling a ballast tank. On the boat being submerged, firing the boilers is dispensed with by a metallic reservoir for hot water fitted at each end of the craft, and the steam emanated from this and the boiler, is stated to be adequate for a 12 miles' run. The boat is kept in a horizontal position by bow rudders. The boat is entered by a circular aperture at the top. It is surmounted by a thick glass dome, through which the helmsman can see to steer with an ordinary wheel and rudder. There is a sufficiency of air in the boat when closed up to supply three men for six hours without discomfort. The design of the inventor of this craft is to approach an enemy's ship with the dome awash until within danger of being seen, then to sink the boat, drive her within striking distance, and then shoot a torpedo therefrom, as from a surface torpedo boat. This boat was purchased by the Greeks. Two larger ones have been built for the Turkish Government. Mr. Nordenfeldt's first submarine boat was tried on September 23rd, 1885, at Landskrona, in the presence of the Prince of Wales and a commission of naval officers and engineers, representing nearly all European powers.

The boat invented by Mr. J. H. Washington, called the *Porpoise*, was tried at Liverpool in March and April, 1885. It is the first submarine boat which is practically driven by electrical power. The craft is 37 ft. in length, and 6 ft. in diameter amidships, and tapers to a point at both ends. She is surmounted with a coning tower, and watertight scuttle. The boat is submerged by water ballast until it is just seen in the water; but inclinable side planes are used to entirely submerge it, while to keep the craft in position self-acting horizontal rudders are used. Compressed air is provided in large compartments at either end.

Professor J. H. L. Tuck, of New York, has also invented a new submarine torpedo boat called the *Peacemaker*. She is built of iron, and is spindle-shaped. Her length is 30 ft., her beam 8½ ft., and her depth of hold 7½ ft. The bow and stern of the boat taper off from amidships, and the forward end of the craft is capped with a glass dome, 12 in. high, through which the helmsman can direct his course when the boat is on the surface. Upon it being submerged the boat is steered by the compass. Electric incandescent lights are used for illuminating purposes. The boat is entered by a circular scuttle near the stern, which can be hermetically sealed from the interior. A screw propeller and a rudder of the ordinary kind are fitted at the stern. Two horizontal rudders are provided whereby the boat can be removed up and down. The inside of the craft, which is about half filled with machinery, contains a 14 H.P. Westinghouse engine, supplied with steam from a caustic potash boiler. Fifteen hundred pounds of the soda, of 95 per cent. efficiency, will enable this boat to be driven for five hours. The boiler is charged from an outside source. Provision is made for storing the necessary compressed air, which is done in the fore end in 6 in. pipes running round the inside. Means are adopted to supply and purify the air in a systematic and agreeable manner. Pig lead is used for ballast, and light supplied by a glow lamp. By the use of side rudders the craft descends at an angle of 15 degrees, and the depth to which it has sunk can be ascertained by a pressure gauge. There is no tendency for the boat to capsize on account of the position of the centre of gravity. She has remained for twenty minutes under the water with five persons on board, and is stated to have easily run at 8 knots an hour with 120 lbs. pressure of steam. When the boat has arrived at a safe distance from an enemy's ship it is intended that the torpedoes are to be fired by electricity. Two torpedoes are arranged to be held together by a chain, and fastened to cork magnets, which it is said will attach themselves to the iron or steel sheathing of the man-of-war whose destruction is aimed at. The first trial of the *Peacemaker* was made in August last, when she went below the surface of the water to a depth of 45 ft., and was propelled, while submerged, for two miles and a half, and was under complete control, and manœuvred remarkably well. Upon her next trial she was driven under a river steamer which was going at 15 knots an hour. These good results appear to have been followed by others at a subsequent trial of the boat.

Another submarine boat, called the *Nautilus*, has been built by Fletcher, Son & Fearnall, of Limehouse, from the designs of the

late Mr. J. Ash. This craft was tried on the 27th of November last in the West India Dock. The hull is constructed of Siemens-Martin steel, the plating being $\frac{5}{16}$ of an inch thick, and sufficient, it is thought, to resist the pressure of the water at a depth of 70 fathoms. The boat is 60 ft. long, and 8 ft. in diameter amidships. She is of cigar shape and has an upper deck of about 20 ft. long, and 3 ft. wide, which barely projects above the surface of the water when the craft is fully fitted up. To submerge the boat it is only requisite to reduce the entire displacement of 50 tons by half-a-ton; this work is done by four pairs of hydraulic cylinders, each pair is fitted horizontally right and left, which can be slided in or out by a screw worked by manual power or by gearing from the electro-motors. The manipulation of these cylinders ensures the boat descending or rising on an even keel as the displacement diminishes if they are drawn in, and *vice versâ*. The craft is fitted with vertical and horizontal rudders. The propulsion of the boat is effected by twin screws, each of which is directly worked by an Edison-Hopkinson dynamo used as a motor of a maximum H.P. of 22·5, at 750 revolutions. Six persons were on board during the first trial, and the craft was driven out into the open water of the dock submerged, and ascended to the surface and returned to the quay. No artificial arrangements were made for supplying or purifying the atmosphere of the boat, as the quantity of air therein is comparatively large; it is sufficient for a crew of six men if the time the boat is under the water is not unduly prolonged. This result is attributable in a great measure to the use of incandescent electric lamps for the interior lighting of the boat, by which fresh air is not in the least contaminated. The centre of gravity is kept down by water-ballast, whereby the boat is prevented from capsizing; the water ballast is also used for regulating the weight of the *Nautilus*, amounting to the number of people aboard in the first instance. The boat is entered by an opening in the upper deck; a small coning tower with four sight holes, covered with plate glass, is fixed above the deck to enable the pilot to direct the course of the boat. The speed of the craft is 10 knots an hour, which is a very creditable performance for a submarine boat.

We agree with the observations of Mr. Nordenfeldt before the Royal United Service Institution respecting submarine warfare, that "the principal *raison d'être* of a submarine boat is the suddenness of its attack, and if the attack by torpedoes fired from a submarine boat is more effective than that fired from a surface boat, while the crew is less exposed in the submarine boat, it should find its place among the armament of nations."

There are several important difficulties to be overcome before these boats can be counted upon to render material service as offensive operators in warfare. One of these difficulties is to see for a considerable distance under water from the bull's-eye of the boat. If the means of attaching torpedoes to the bottoms of the enemy's ships are to succeed, this disadvantage must be surmounted. It is thought that when a torpedo is released or fired that it will so alter tho displacement whereby she might come to the surface at a dangerous moment. It is likely also, as the Duke of Edinburgh stated at the Institution referred to, that when the torpedo explodes it would blow in the side of the boat and kill the crew.

It is probable that by further improvements and careful trials the problem will be solved how these boats may become powerful factors in warfare. So great has been the progress which has been made, and is likely to be made, in submarine boat inventions, that it behoves Governments to take careful notice of them, and the result of their trials.

Another submarine boat which was constructed for Mr. Nordenfeldt at Barrow-in-Furness made the first of several trials a few weeks ago to which it is to be subjected at Southampton. The test was made in the presence of a body of naval, military, and engineering experts and other scientists.

This is the fourth submarine craft built for Mr. Nordenfeldt, but is far larger and more powerful than the previous ones, which are in the possession of the Greek and Turkish Governments. The last built boat, which has been christened the *Nordenfeldt*, also differs in shape from the three foreign-owned craft, which are cigar shaped. The former is 125 ft. long, 12 ft. beam, and has a depth of 12 ft. at both ends. At her midship section she is quite round, and a wedge at stem and stern. Her displacement when fully submerged is 245 tons, and equals 160 tons when acting as an above-water craft. The draft of water of the *Nordenfeldt* when laying alongside the wharf at Southampton before her trial was about 11 ft. 6 in. aft, and 10 ft. forward, leaving about 2 ft. of her 1 in. steel turtle back and 6 in. of her stern above water.

The boat is fitted with peculiar engines, whose work is only to turn the main driving propeller. These engines are double compound, and have two cylinders of 15½ and two of 26½ in. diameter, with a stroke of 16 in., which work on four cranks on one shaft, and will develop about 1,200 H.P. Each cylinder is fitted with patent balanced slide valves, and worked by Joy's valve-gear. A separate pair of engines drives air circulating and fuel pumps, and two pairs of engines are used for submerging the boat. There are also two fan engines for supplying the draught to the furnaces when the boat is being driven at full speed above water. A pair of steam steering engines are also provided. Two large marine multitubular boilers, made of steel, are used for supplying the steam. Their diameter is about 10 ft., and their respective length 20 ft. and 11 ft.

The entrance to the stoke-hole is situate in the centre, through a man-hole 3 ft. in diameter, which is fitted with a heavy steel door, wherein there is a glass through which light is admitted to operatives below. This door is rendered tight by india-rubber, and securely fastened by a screw and wheel in the interior, which can be manipulated by the stokers. The funnels are fixed fore and aft of this aperture. The bases of the funnel stand 10 in. above the top of the boat, while the entire height of the funnels is 10 in. when the boat is ready to go below. It is stated, however, that when this craft is finished, the funnels will be telescopic, shutting down level with the deck.

The coning towers, which are about 2 ft. high, are placed 30 ft. from the stem and stern of the boat, and are of equal diameter. They are made of 1 in. steel, and are quite impervious to any projectile which would ever be directed against them in warfare. Heavy doors are fitted in the towers, wherein glass cupolas are fixed just capacious enough to admit the captain's head to enter when he requires to manœuvre the craft. In the forward tower he has all the necessary apparatus for firing the torpedoes, of steering her by steam, of instantly giving her enormous buoyancy when necessary, of knowing her depth under the surface, and of ascertaining whether she is horizontal, of communicating with the engine-room and stoke-hole, and regulating every motion of the vessel.

The compartments into which this boat is divided are very neat, and are required for the following uses:—The first is the torpedo chamber, which is fitted with two impulse tubes, and a torpedo in each, with a supply of two other missiles; the second contains the officers' quarters, which are well and comfortably fitted up for four officers, and are far superior to the quarters provided in a first-class torpedo boat; the third compartment is the boiler-room, which contains the two ordinary boilers fixed fore and aft, with the stoke-hole amidships; the fourth receptacle is the engine-room, consisting of the machinery before mentioned; while the fifth compartment is used as the men's quarters, cooking galley, and for stores, &c.

When the boat is closed, she contains enough air for the crew of ten men for a much longer time than it can ever be necessary for her to keep shut. The means of submerging and the principle of working her is very simple. On being superheated the steam is passed from the boilers into reservoirs, to be utilised as required. Nearly 27 tons of superheated steam and water can be stored in such receptacles and the boilers. Thirty-five tons of cold water can be admitted, and when they are entirely full the boat dives down into the water until the coning towers are awash. The funnels being now taken away, the stoke-hole shuts, and the craft ready for sea, there is but a small amount of buoyancy to overcome. This is accomplished by working two screws placed vertically and recessed at either end of the craft, whereby it is dragged below the surface. The apparatus by which these screws are worked is adjusted in such a manner, that by moving a handle the revolutions are accelerated or decreased at the will of the captain, while the boat is retained in a horizontal position.

Sufficient power is provided by the 27 tons of hot water and steam to drive the boat 20 knots with fires extinguished; and this water can, when necessary, be blown out of the boat in five minutes. Three pumps are used to clear her of the cold water, which will empty the tanks in seven and a half minutes. The bunkers adjoining the boilers have a coal carrying capacity of eight tons, which is stated to be adequate to raise steam for a run of 1,000 knots, at about a speed of eight knots an hour. If the fuel endurance of the craft is required to be increased, the ballast tanks have been so arranged as to carry about twelve tons additional coal, and which would enable the boat to steam 2,500 knots at low speed. The boat is illuminated by ordinary candles, which take up but a small space, and show when burning the properties of the air.

As some of the crew were new to the craft, it was not intended on this occasion to entirely submerge her, but firstly to try her

with her coning towers awash, and everything closed up to show how she would operate with the superheated steam, and then to open everything up and test her speed working as an ordinary first-class surface torpedo boat. The buoyancy was first reduced by admitting water into the tanks, the funnels being taken down and passed into the stoke-hole, at the same time the furnace doors being shut, and the fires hermetically closed in. The funnel bases being then closed, the buoyancy was so far diminished that none of importance remained on the surface except the two coning towers and a few inches of her back.

The *Nordenfeldt* steamed out of the dock at a speed of from six to eight knots. She was almost invisible at the distance of 700 yards on account of the leaden colour in which she was painted, the two turrets and a few inches of her turtle back alone showed above water. As these are very strong, and are of such a shape as to best encounter the shots from hostile guns, it is highly probable that no quick-firing gun carried in a torpedo boat will do her any injury. She has also the great advantage of being able to act on the offensive without noise or smoke. About an hour and twenty minutes was taken up in the trial, but enough steam was stored up in the boilers to drive her about twenty knots. The powerful pumps with which she is fitted were put in motion, and in about eight minutes about twenty tons of water were pumped out, which gave the boat a free board of 2 ft. On the funnels being again fixed, the fires re-lighted, and the fans set going at full speed, steam was quickly indicated at 100lb., and a run was made for thirteen knots at about three-quarter speed, the highest being about fifteen knots. A Yarrow torpedo boat having appeared on the scene of operations, the great difference shown by the targets in the two boats was a matter of much general remark from the deck of the *Alexandra* steamer, chartered for the accommodation of the visitors. While the first-class torpedo boat presented a target that could easily be hit and penetrated by a quick-firing gun, the *Nordenfeldt* at the same distance was scarcely visible, and from her peculiar build, merely showed a curved exterior from which most shots would glance.

Although there was a high temperature on board during the closed run, it was tolerable. During runs above water, however, when the fans are in operation, the whole boat is fresh and cool. When propelled at good speed, a bow and stern wave was created by the craft which completely hid her body in a hollow, the funnels being only seen; no water, however, got down her coning towers, as it was thought it would in this case, when they were open to admit air to the fans.

All the officers and crew who witnessed the operations of this boat, much admired her capabilities, and the craft appears to have more than realized the sanguine expectations which were formed as to her powers as an engine of warfare.

On the 7th of June last, a trial trip was made at Constantinople of the No. 2 submarine torpedo boat, lately built for the Turkish Government. This test was made by the Sultan's orders and under his own inspection. The southern entrance to the Bosphorus was the place selected for this purpose, which was about the worst for such a test, as it was a crowded thoroughfare with currents set in all directions. The base of operations, however, suited the convenience of his Imperial Majesty, as on the date mentioned, the Sultan had to spend several hours in the palace domains at Seraglio Point, in the exercise of one of the most important duties connected with the Caliphate.

The boat when ordered to leave her moorings for the tests at 2 p.m. was then lying under banked fires, but the necessary 150 lbs. pressure was in the reservoir. The water was heated up the previous night. In preparation for war, this would be the prepared condition of the boat; when once thus heated, the water can be maintained in the required condition for any time by using from two to three cwt. of coal. On account of special protective coverings of the boilers, the loss of heat by radiation is very insignificant, while the pressure in the reservoirs does not fall more than 10lbs. in the twenty-four hours. Consequently the craft is always thus ready for the submarine part of her operations, and can also be got under weigh for general work as quickly as any other kind of steamboat.

Much admiration and surprise was expressed at the old bridge at Galata on the approach of this No. 2 submarine boat. She proceeded very rapidly down the Go'den Horn, and made her way very skilfully between the numerous lighters and caiques which persisted in keeping their course, notwithstanding the efforts of the pilots in their launches to make them diverge from it. She shot the bridge at high speed, which was considered a difficult accomplishment, owing to the narrow width of the opening and a severe current which sweeps across it. As she is painted of a light grey colour, but little could be seen of her above water except the dome and upper portion of the torpedo tube, which might easily have been mistaken in the distance for the hump and fin of some monster sea fish.

According to the order of the Sultan, who directed the trials from the shore, the boat laid for about a quarter of an hour in the strongest part of the current off Seraglio Point, and by a few turns of the screw she kept her position with the greatest ease, but the pilot launches were compelled to take to the shore. She narrowly escaped material injury when in this position. A large lighter which was crossing the stream, and hugging the wind to save ground, passed too close, and was struck by the screws of the submarine boat, which caused a few inches to be severed from the end of the blades of the latter.

She was first ordered to attack as a surface boat a merchant steamer lying off the Scutari shore, and turning in a little over her length, steamed across the current for this purpose. End on, but very little was seen of her, and the target which she offered was remarkably insignificant, being merely a dome with a bit of a chimney in it, while broadside on, the difficulty of perceiving her was greatly increased by the bow wave. The boat appeared to cut her way through the water like a plough, banking up the fluid on either side as it rolled over the snout, thus forming a furrow in which she would be entirely invisible but for the small chimney necessary to be kept in place for maintaining the proper state of the fires.

On nearing the merchant ship two or three jets of water were suddenly thrown upwards, to fall in showers of spray. This was caused by the opening of the torpedo tube door, which in action would have marked the despatch of her destructive weapon. On opening the door the water rushing in drives out the air with the effect just described. At that moment she looked more like a whale than previously, and might have been taken for one spouting.

After the result of this attack, a test was made of her speed as a surface boat against the current. She was driven even steadily ahead, and performed at the rate of eight knots over the ground without difficulty against the full strength of the current of the Bosphorus, which was running at nearly five knots. This work proved that she could maintain a speed of more than twelve knots, which is an excellent result when it is considered that she was only made to steam ten.

On her return from this run, at the desire of the Sultan, a second attack was arranged, to be made on the before-mentioned steamer, but upon this occasion as a submarine boat only. The funnels having been lowered, the Nordenfeldt craft went ahead, gradually sinking as the ballast tank was filled to diminish the buoyancy. She became suddenly lost to view on reaching the steamer, but shortly afterwards came steaming round from the other side. The boat was supposed to have launched her projectile below water, and then changing course risen to the surface in another direction to facilitate escape in the event of a mine being laid. As the escaping air expended its force before coming to the surface, no jet was thrown up.

The Sultan expressed himself highly satisfied with the trials of the craft. The boat was under weigh for more than five hours, during two of which she was propelled under her good supply of reserve steam. She also used the steam for her return passage up the Golden Horn. It was ascertained that on arriving at her moorings there was still 90lb. pressure in the reservoirs, whereby she could have continued under weigh for a considerably longer time.

It is reported that the Government of Spain has recently granted Mr. Isaac Peral, a Spanish naval officer, a credit of £1,000 for a new submarine craft. This was done on the recommendation of a Select Committee of Admirals and Naval Engineers, who had carefully examined the plans of the proposed boat. It is added that this craft will be completed in about four months, will carry four men, who will, if required, be able to remain four days beneath the surface of the sea.

The British Government would do well to consider the propriety of adding a sufficiency of submarine boats to her Navy as soon as possible, as there is every reason to believe that they will be much used in future great maritime wars.

The two new wood-sheathed protected cruisers, *Magicienne* and *Marathon*, are to be built for the Admiralty by the Fairfield Shipbuilding Company, Govan. The vessels are to be 265 ft. in length by 42 ft. beam and 19 ft. draught, the tonnage being 2,950 tons, the estimated speed 18 knots.

... ENGINES FOR ATLANTIC STEAMERS.*

...he best type of engines for our Atlantic mail and ...steamers is one of considerable interest to all ...rs, and may be profitably discussed from time to time ...nts are made in marine machinery. In the title of this ... used the word "compound" in its widest sense, as ...ll engines expanding their steam in two or more stages. ...approve of the practice so common of distinguishing ... "compound" and "triple or quadruple-expansion" ..., as these latter are still more deserving of the term "com... " than the older form; and the use of the term "ordinary ...pound" is unsatisfactory, as before long triple and quadruple ...pansion engines will be the "ordinary" compound engines in .... I therefore suggest that the term "double expansion" be substituted for engines in which the steam is expanded in two stages, and shall endeavour to adhere to that term throughout this paper. Mr. John, of Barrow, in his paper on "Atlantic Steamers," read at the Liverpool summer meeting of the Institution of Naval Architects last year, pointed out that the large Atlantic lines were very much behind in the type of engines employed, none of the principal companies running to New York having adopted triple-expansion engines, although for some years past vessels of considerable size and power had been working successfully with engines of this description. The *Propontis*, built by Messrs. Elder, under the management of Mr. Kirk, had been successful so far as her engines were concerned; and later, Mr. Kirk, at Napier's, had been successful with the *Aberdeen* and some steamers for the Mexican line; and yet when these latter vessels came to Liverpool, and the principal companies sent their engineers to report upon them, they were advised not to adopt the new system.

The principal types of engines hitherto employed in the Atlantic service may be classed under three heads: (1) The ordinary two-cylinder compound engine with intermediate receiver and cranks at right angles. (2) The tandem engine with four or six cylinders—not working, however, on the Woolf principle, as in the earlier engines of this type, but on the receiver principle, the high-pressure cylinders exhausting through pipes to the low-pressure valve casings. (3) The three-cylinder engine, with cranks at equal angles round the shaft, and having one high-pressure cylinder delivering into two low-pressure ones. Of these three types, the first was used in the earlier days of compound engines as applied to Atlantic steamers, and has continued to be employed for engines up to 3,000 or 4,000 I.H.P., but above this the other two types have been most in favour, especially the three-cylinder engine, which we find in the *Arizona* and *Alaska* of the Guion Line, the *America* of the National Line, and the *Gallia*, *Servia*, *Aurania*, *Umbria*, and *Etruria* of the Cunard Line. The tandem type has been chiefly confined to the vessels of the White Star Line and the *City of Rome*.

The first cause of the large consumption of fuel by these steamers is, in my opinion, the smallness of the engines in proportion to the power developed, in consequence of which the steam is not expanded far enough to produce a very economical result. In some of the early compound marine engines, such as those fitted to the coasting paddle steamers of the Pacific Steam Navigation Company, some twenty years ago, the steam was expanded down to a pressure of about 6 lb. absolute in the low-pressure cylinders; and these vessels used to run with a consumption of 2¼ lb. of coal per I.H.P. per hour, and sometimes less, although the boiler pressure was only 40 lb. In the early ships of the African Mail Company I believe that similar results were obtained, although all these engines worked on the Woolf principle, which is much less efficient than the "receiver" one when both are carried out in the best manner.

The majority of the large Atlantic steamers of the present day burn very little less coal than these did, in spite of the increase of pressure from 40 lb. to 110 lb., and the much higher piston speeds now employed. I believe that the White Star boats have run ever since they were built, some fifteen or sixteen years ago, with a consumption of less than 2 lb. per I.H.P. But these vessels have not the large powers and high speeds of the later built Atlantic liners. In fact, it seems that the increase of pressure and piston speed has been used solely to augment the power given out in proportion to the size of the low-pressure cylinders adopted, and not to allow of a greater expansion of the steam and consequent increase of economy. This seems to me to be a mistake, and I believe that in the long run it would prove cheaper to make the engines larger for their power even at a somewhat increased first cost, and to work the steam more expansively. In the large majority of merchant steamers other than mail and fast passenger boats, the usual working power of the engines is considerably below the maximum, and consequently while the mail steamers are continuously burning some 2 lb. to 2½ lb. of coal per I.H.P. per hour, there are many cargo boats running even with double expansion engines at a consumption of about 1½ lb. per I.H.P. per hour at their ordinary speeds. And I believe there are triple-expansion engines running with a consumption of little over 1¼ lb. In the Atlantic mail service, however, we have a totally different condition of affairs, the ships running continuously at their maximum power, or nearly so, when once they have cleared the docks or harbour whence they start. Their engines might, therefore, advantageously be proportioned for the greatest possible efficiency when giving out their full power. In other vessels it is necessary to allow for working at lower powers for long periods together, and this means more expansion, but in the mail boats no such allowance is necessary. In the early screw steamers of the Pacific Company, viz., the *Magellan*, &c., indicating some 2,000 H.P., and working at 60 lb. boiler pressure, the low-pressure cylinders were 96 in. diameter, and the piston speed was not more than 480 ft. to 500 ft. per minute. If the steam in the *Umbria* and *Etruria* were expanded to the same terminal pressure in the low-pressure cylinders as in the *Magellan*, then allowing for the increased piston speed of some 800 ft. per minute, and for the higher mean pressure due to expanding steam at a boiler pressure of 110 lb. down to the same terminal pressure, the low-pressure cylinders of these latter engines would require to be about 129 in. diameter instead of 105 in. Taking these engines as 14,000 I.H.P.—they have worked to over 15,000—and halving this, as there are two low-pressure cylinders, and taking the piston speeds of these and the *Magellan* class at 800 ft. and 480 ft. respectively, we get for the same power:

$$800 : 480 :: 96^2 : 74\tfrac{1}{2}^2 \text{ nearly,}$$
$$\text{and as } 2000 : 7000 :: 74\tfrac{1}{2}^2 : 139^2$$

Then, taking the expansions in proportion to the initial pressures, or as 60 + 15 to 110 + 15, *i.e.* 75 : 125, and calling that in the *Magellan* class 9, and in the *Umbria* class 15, the mean pressures all referred to low-pressure cylinders will be approximately in the proportion of

$$75 \times \frac{1 + \text{hyp. log. } 9}{9} : 125 \times \frac{1 + \text{hyp. log. } 15}{15} \text{ or } 106 : 123.$$
$$\therefore\ 123 : 106 :: 139^2 : 129^2 \text{ nearly.}$$

Thus our fast Atlantic steamers have smaller cylinders in proportion to their power than the average cargo boat, even allowing for higher piston speed and pressure.

The second cause of large fuel consumption is one common to most of the compound engines made for marine purposes, whether double or triple-expansion, and that is, the drop of pressure between the different stages of expansion. I do not wish to overrate the loss of power due to this cause or to lose sight of the probability that some of it is probably regained by the superheating action which is said to take place when the steam expands into the receiver without doing external work. But I think that, considering how low the total efficiency of our marine machinery—including boiler, engine, and propeller—is, we ought to try and gain every advantage we can, taking care that in avoiding loss in one direction we do not create one elsewhere. It is only by combining together the diagrams from the different cylinders in a correct manner that we can arrive at a just estimate of the losses in the cylinders of any kind of compound engine, and there are some losses which we cannot ascertain with any degree of accuracy from diagrams at all. The losses, however, due to the disproportion between the ratio of cylinder and the cut-off in the later one are discoverable from properly constructed combined diagrams; and a careful study of these will show that a considerable loss of area—viz., of work done for steam used—is caused by the drop between the terminal pressure at the end of the first cylinder's stroke and the back pressure at the beginning of the return stroke. This loss may also be approximately calculated from theoretical diagrams or from the ordinary calculations for compound engines, such as those found in D. K. Clark's tables or in Holmes' new text book of the steam engine. But the losses will not then seem so great in proportion to the work done as they really are, as these calculations and theoretical diagrams do not take account of the other losses which we find shown on actual diagrams, such as those due to wire-drawing, early release and compression, and drop or difference between the back pressure in one cylinder and the admission pressures in the next. This latter "drop" must not be confounded with that previously mentioned. The whole loss of

* *Paper read by Mr. J. Jennings Campbell before the Liverpool Engineering Society.*

area from "drop" is caused by the difference between the terminal pressure in the first cylinder and the cut-off pressure in the next. This is made up of the two "drops" or differences of pressure already referred to, which are due to quite different causes. The difference between the terminal and minimum back pressure in the first cylinder is due to the volume of steam admitted to the second cylinder being greater than the volume discharged from the first at terminal pressure. The difference between the back pressure in the first cylinder and the admission pressures in the second is due partly to the friction of the passages from first cylinder to receiver and from receiver to second cylinder, and partly to initial condensation and wire-drawing in the latter. The first can be entirely eliminated, but the second can only be reduced to a minimum.

Take an example:—Suppose we have an ordinary double expansion engine with cylinders having a ratio of 1 : 4, and cutting off at half stroke in both cylinders, the initial pressure being 80 lb. absolute. Then disregarding clearance and compression, and assuming a receiver so large as to give a practically constant pressure therein, we shall have a terminal pressure of 40 lb. in the high-pressure cylinder; and as the volume of steam admitted into the low-pressure cylinder is twice the capacity of the high-pressure—or twice the volume discharged at terminal pressure from the high-pressure—the pressure in the receiver—which we may take as being the same as back-pressure in high-pressure cylinder and admission pressure in low-pressure cylinder—will be 20 lb.; therefore the mean pressure in H.P. will be:—

$$= \frac{80}{2} \times 1 + \text{hyp. log. } 2 = 67{\cdot}7 \text{ lb.}$$

Deducting back-pressure		20
Effective mean pressure	=	47·7 lb.

This, divided by 4 (cylinder ratio) = 11·925 as the equivalent pressure per square inch of low-pressure piston. In the low-pressure cylinder we have:—

$$\text{Mean pressure} = \frac{20}{2} \times 1 + \text{hyp. log. } 2 = 16{\cdot}9$$

Back pressure, say		3·0
Effective mean pressure	=	13·9 lb.
Add H.P. mean pressure ÷ 4	=	11·925 lb.
Total effective mean pressure	=	25·825 lb.

for the whole engine, all referred to low-pressure cylinder. If we had no drop, the mean pressure should have been the same as if we had expanded 80 lb. steam eight times in one cylinder the same capacity as our low-pressure cylinder, viz.:

$$= \frac{80}{8} \times 1 + \text{hyp. log. } 8 = 30{\cdot}8 \text{ lb.}$$

Less back pressure as before	=	3·0 lb.
we have effective mean pressure	=	27·8 lb.

showing a loss of nearly 2 lb., or 7·2 per cent.

If we assume that the other and unavoidable losses due to wire-drawing, release, compression, &c., amount to 20 per cent., or say 5·6 lb. in each case, we have 20·225 and 22·2 as the effective mean pressures instead of 25·825 and 27·8, or a loss due to drop = 9·0 per cent. instead of 7·2. In addition to this the compression in the high-pressure cylinder will practically reduce the volume of steam discharged from the high-pressure cylinder, while the imperfect compression in the low-pressure cylinder leaving a portion of the clearance to be filled from the receiver, slightly increases the volume of steam admitted to the low-pressure cylinder; so that the volume actually admitted to it will be more than twice the volume discharged from the high-pressure cylinder at terminal pressure, and consequently the receiver pressure will be less than 20 lbs., and the drop therefore greater. If both cylinders had clearances equal to 10 per cent. of their working capacities, and if the high-pressure cylinder compressed at seven-tenths of the stroke, and the low-pressure just enough to half-fill its clearance—or fill it at half the initial pressure—then the volume of steam discharged at 40 lbs. from the high-pressure cylinder will be 85 per cent. of its working capacity, while the volume admitted to the low-pressure will equal $2\frac{2}{10}$ the volume of high-pressure cylinder, so that the receiver pressure will be $= 40 \times \frac{8{\cdot}5}{22} = 15{\cdot}45$ lbs., instead of 20 lbs., giving a greater drop, and consequently a greater loss of efficiency.

There are no two opinions as to the loss of area in the combined diagrams thus caused by drop, but many engineers endeavour to make out that most of this loss is recovered in another way, owing to the superheating action caused by the steam expanding into the receiver without doing external work, *i.e.*, without doing other work than that necessary for the separation of its particles. Others, again, defend the acceptance of this loss on the ground that it enables them with the ordinary types of engines to equalize the initial strains on the working parts, and obtain tolerably equal powers in the cylinders without a large high-pressure cylinder and a very early cut-off therein.

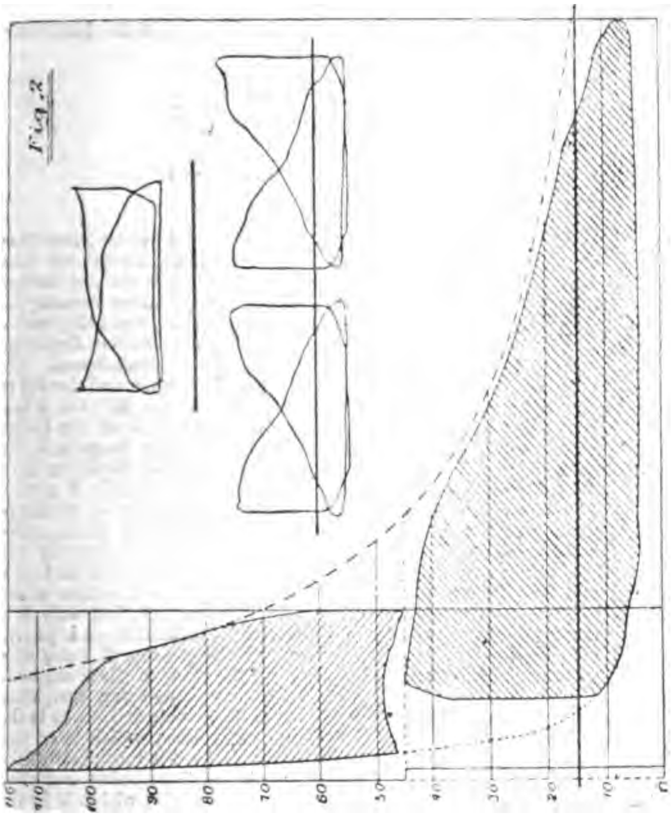
In the case of two-cylinder double expansion engines and the ordinary type of three-cylinder triple-expansion engines, the latter arguments have a certain degree of force if not carried too far, but much less than is generally supposed; and, as to the first argument, I believe there is very little in it, and that the superheating is far from sufficient to make up for the loss of area on the diagrams. The most successful two-cylinder engines I have known had comparatively small cylinder ratios, and correspondingly greater expansion in the high-pressure cylinder.

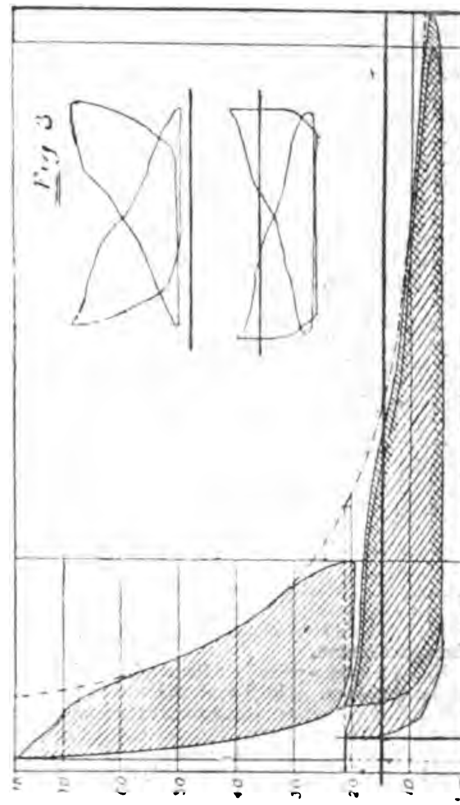
In the case of tandem engines and three-cylinder double expansion engines the conditions are different, and much better driving pressures can be obtained with smaller cylinder ratios and earlier cuts-off in both cylinders. In the latter type of engines, when worked with large cylinder ratios, the difficulty has been to keep down the power in the high-pressure cylinder relatively to the two low-pressure without either an inconveniently early cut-off in the low-pressure or a very late admission to the high-pressure. And in speaking of this late cut-off in a cylinder, there is a point which does not receive sufficient attention from marine engineers, and that is, the effect of the inertia of the reciprocating parts. In fast-running engines with a late cut-off, the pressure acting upon the crank pin in the direction of the piston's motion towards the end of the stroke, due to the combined action of steam and the momentum of the moving parts, is surprising to those who have not worked it out, and is far greater than the maximum steam pressure during the stroke, and this in spite of the moderate cushioning on the other side of the piston which can be obtained when the cut-off is late—say at two-thirds or three-quarter stroke.

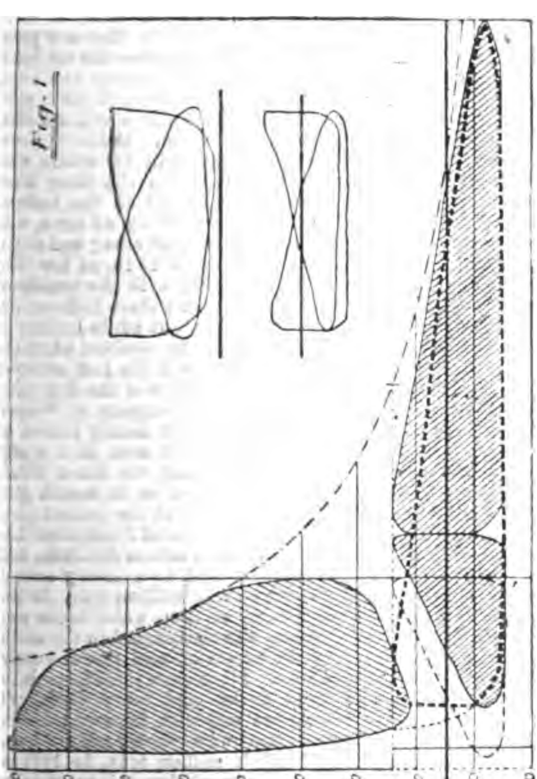
I should have liked to go further into this matter if I had more time, but in the meanwhile I strongly advise every one to read carefully the paper upon this subject which was read about a year ago by Mr. Arthur Rigg at the Institution of Naval Architects, and afterwards published in "The Engineer," 4th June, 1886. From the information therein contained, and also from some of the diagrams in the author's treatise on the steam engine, it will be seen that the best results are generally obtained, as regards equality of twisting moments, when steam is cut off pretty early—say at one-third or quarter stroke. I am strongly in favour of reducing the "drop" between cylinders as much as it can possibly be done without upsetting the working pressures in other respects. This is such a large subject that it would almost require a paper to itself, and I must pass on to other matters.

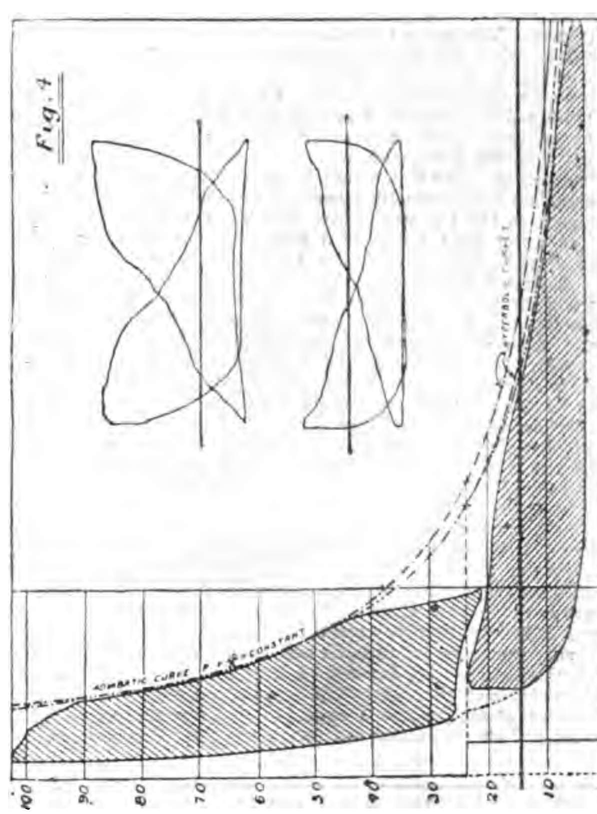
The third cause of inefficiency in all classes of compound engines is a disregard of the point I have just alluded to, viz., the wonderful effects of inertia; and although there are a few engines running in which the steam distribution is good in relation to this matter, I fear it is not the case in the large Atlantic steamers, especially in the high-pressure cylinders, where the admission generally extends far beyond the half-stroke, and often reaches two-thirds or seven-tenths, while in the low pressure cylinders, the diagram generally shows a steady fall all the way. I have here diagrams combined from the indicated cards of various types of compound engines. These are all combined on the system recommended by Mr. Schönheyder at the discussion on the late Mr. Wyllie's paper, read at the Middlesborough meeting of the Institution of Mechanical Engineers, and previously more clearly described by him in a letter to "Engineering" on October 27th, 1871.

Fig. 1 is from a set of tandem engines in the Atlantic mail service; and here you will see that there is a large drop due to the late cut off in the low-pressure cylinder and the tolerably large cylinder ratio. There is also a great difference between the back pressure in high-pressure and admission pressures in low-pressure cylinder, as shown by the small dotted figure, which shows the low-pressure diagram the same length as the high-pressure, and in the proper place relatively to it for showing this point. The full lined figure shows the low-pressure diagram divided into two, and placed in the correct position for comparing its expansion curve with the theoretical one carried on from the high-pressure diagram. The dotted line simply shows the low-pressure diagram extended to a length proportionate to the capacities of cylinders. The theoretical curves are hyperbolic.









ON COMPOUND ENGINES FOR ATLANTIC STEAMERS.

Fig. 2 is a combined diagram of a set of three-cylinder engines belonging to one of our large Atlantic liners, but I am not at liberty to give either the name of the ship or the company under whose flag she sails. In this diagram you will notice that the low-pressure diagram is about twice the area of the high-pressure one on account of there being two low-pressure cylinders, and, in fact, at the power developed when these cards were taken the power in the three cylinders is almost identical. This figure illustrates the remarks I made about "drop," for although the cylinder ratio is only a little over 4 : 1 and the low-pressure valves cut off at about 35 per cent. of the stroke, there is more drop than you would expect, owing partly to the compression in the high-pressure cylinder and partly to the low-pressure clearance not being completely filled with steam at the initial pressure. These engines give a very high speed with a consumption of a little over 2 lb. per I.H.P. per hour.

Fig. 3 is from a pair of two-cylinder compounds built many years ago on the East Coast, and said to have worked on the trial trip with a consumption of only 1·4 lb. per I.H.P. per hour, but as the trial only lasted two hours this record is not very valuable. But even if they did not work quite so well as this there is no doubt that they were very economical afterwards when in actual service. To show the advisability of combining diagrams, I may mention that when I selected these cards for illustration I thought from their appearance that I should have found less drop than actually exists. When I first plotted this diagram, I combined it in the usual manner, *i.e.*, setting the diagrams of each cylinder at a distance from a vertical line, representing the zero of volume, corresponding to the clearance space in that cylinder. I subsequently discovered that this plan was wrong, and the red outlined figure shows the low-pressure figure placed according to Mr. Schonheyder's method, and in its correct position relatively to the theoretical curve.

Fig. 4 is from a pair of similar engines to Fig. 3, but working at a higher pressure. These engines are very economical, but I have selected the diagrams on account of some interesting experiments that have been made on the condensation in the cylinders. The cards shown represent a consumption of about 1·66 lb. per I.H.P. per hour with South Wales coal, the engines indicating about [illegible] I.H.P. There are no jackets to the cylinders; and I have made the theoretical curves adiabatic instead of hyperbolic, as I found that the latter showed a greater quantity of steam just after cut-off than just before release, which is not likely to be correct. The amount of water condensed in the high-pressure valve-casing, *i.e.*, before the steam enters the engines at all, is [illegible] gallons per hour, and the quantity obtained from the low-pressure valve-casing forming part of the receiver is equal to [illegible] gallons per hour* = 10·8 tons in 24 hours. When the water is not drawn off from the receiver a considerable amount is [illegible] the low-pressure cylinder; but when this is done none [illegible]. The water runs into a small tank fixed under the [illegible] and fitted with a gauge glass, and is drawn off through [illegible] to the hot well, where it raises the temperature of the [illegible] some 4 deg. or 5 deg. When working the cork is [illegible] to keep the water-level pretty constant.

[illegible] 11 tons a day seems a lot of water to get; but [illegible] the power developed is taken into account, together with [illegible] that this is the only water obtained from both cylinders, [illegible] unjacketed, the quantity is far less than one might [illegible]. Measured from the H.P. cards, which probably do not [illegible] the steam that enters the cylinder, the water used seems [illegible] 11 tons per 24 hours, so that the condensation [illegible] per cent. It is not easy to determine [illegible] of this condensation takes place in the H.P. cylinder or [illegible] in the receiver, but I believe the former to be the case, [illegible] partly of the initial condensation and partly [illegible] to the work done. When these engines are exerting [illegible] power and the ship is light, very little water is [illegible] as soon as the vessel is loaded and the valves opened [illegible] at once. This may be partly accounted for by [illegible] taking place with the earlier cut-off. It [illegible] that these engines have a good deal of compression, [illegible] that they are the same engines I have heard of as [illegible] out to India and back without requiring to let [illegible] brasses. I hope some time, if I can obtain [illegible] of the reciprocating parts, to work out a diagram of [illegible], which I expect to find very uniform when the [illegible] of steam and inertia are taken into account.

(To be concluded in our next.)

* [illegible] gallons in 1 min. 47 sec., or 2,422 gallons per

THE NEWCASTLE - UPON - TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

JUBILEE YEAR, 1887.

(Continued from page 129.)

THE next exhibit we describe is contributed by the River Wear Commissioners, Sunderland. Without doubt the most modern, complete, and realistic exhibits of harbours and harbour improvements, along with the concomitant appliances necessary for carrying out gigantic works of this description, including travelling cranes, radial goliath cranes, dredgers, concrete-depositing barges, &c., are those of the River Wear Commissioners. The first to come to our notice is in front of the large stand devoted to the half and full models of Sir Wm. Armstrong, Mitchell & Co., Limited, and in close proximity to the exhibits of the Italian Government. It represents, on a scale of 40 feet to an inch, the extensive docks and harbour under the control of the River Wear Commissioners at the mouth of that river. While it gives a splendid idea of the extent of the shipping facilities of the enterprising port of Sunderland, including the graving docks, warehouses, coal staiths, &c., it does not afford the visitor any real idea of the shipbuilding and engineering capabilities of that town and neighbourhood, although incidentally the character of the local industries is illustrated. To some extent, but only in a minor degree, this model of Sunderland Harbour is anticipatory, viz., in that the new Roker Pier, now in process of being constructed by the Commissioners, from the plans of their engineer, Mr. H. H. Wake, C.E., is shewn as it will be when completed, and the South Pier is also shewn as it is intended to be in the course of a few years. With these exceptions, which in no way affect the present sea entrances to the docks, the model shows the harbour and docks as they exist at present, there being even now, at the deepest entrance to the Sunderland docks, which is by the sea lock, southward of the river entrance, a depth of water of 27 feet on the gate sill, at ordinary high water. The improvements now in progress are principally intended to improve the direct entrance to the River Wear, by so deepening it as to remove the bar. This is to be accomplished by the new piers, which will be not much short of a mile in length—the old south pier being extended seawards in a straight line—the new north pier starting from a point 1,935 feet north of the old north pier, extending seawards in a direct line to low water mark, and then gradually curving in a south-easterly direction. When the new piers are completed, which it is expected will be within nine years, the width of the entrance at the mouth of the River Wear will be 500 feet, and at high water the extent of the harbour will be increased by 51 acres, and at low water by 40 acres, well protected from the north-east and the south-east seas; and at the pier-heads there will be a depth of water of 29 ft. at low tide, and 43 ft. 6 in. at high water. In connection with the remaining exhibits of the River Wear Commissioners, we shall indicate the method of constructing the new Roker Pier, but while looking at the exhibit now in question, it may be well to recollect what the now flourishing harbour of Sunderland was in the last century. In 1767 the harbour was *non-existant*, the colliers of the day being loaded off the port in the roadstead, their cargoes of "black diamonds" being conveyed alongside in craft locally known as "keels," giving employment to a large class of men, now nearly extinct, known as "keelmen." Even in 1780, the River Wear, naturally not a very large river, was divided at its mouth into three or four branches, and it was not until 1825 the present piers were erected. Like every other port, the trade of Sunderland has hitherto been largely proportioned to the harbour facilities, and we find that the erection of the piers lead to a steady annual export of coals, averaging one and a quarter million tons. In the course of years the great advantages of deep-water docks was perceived, and in 1851 the first one was constructed to the south of the Wear, and in that year the export of coal rose to nearly one and three-quarter million tons. Since then there have been frequent extensions of the South docks, and every additional facility to the loading of vessels has met with increased trade. In 1856 the exports of coal rose to two and a quarter million tons, in 1859 to upwards of two and a half million tons, in 1877 to three and a half millions, and at the present time it is practically at the rate of four million tons annually. The recent expansion

in the trade of the port of Sunderland has been largely due to the construction of a "sea lock," the deepest along the north-east coast—29 ft. 6 in.—designed by Mr. H. H. Wake, C.E., as it admits of the passage of the largest type of ships and steamers from the sea into the south docks at any time of the tide. This sea lock was constructed in 1880, and is 480 ft. long and 90 ft. broad. The remaining exhibits of the River Wear Commissioners are in the south portion of the North Court, in close proximity to the large collection of models, &c., exhibited by the Committee of Lloyds' Register of British and Foreign Shipping. The most valuable of this second collection of models, illustrative of the important works now in progress at the mouth of the river Wear, is a model on a scale of 1 in. to a foot, of a portion of the new Roker pier, showing the mode of constructing it in the most realistic fashion, real granite blocks, concrete bags, iron rails, lamp posts, &c., as on the actual pier, being shown to scale, and on the pier a working model of the magnificent radial block setting crane, a locomotive engine, &c. Even a model of the apparatus used in connection with the Lucigen light is shown. As visitors will see who look closely at the model of the Roker pier, the foundations are of concrete. At first the foundation was formed by excavating in the sand down to the rock, where necessary coffer dams being erected and concrete deposited, but as deep water was reached resort had *per force* to be made to another plan. A vessel of the hopper barge type was used for depositing 100 ton bags of concrete, which had previously been prepared, but in a short time a specially constructed twin-screw steamer the *Quiam* will be discharging this duty even more efficiently. On the concrete foundation, which is brought up to about low water level in the manner already indicated (after it has been levelled by the addition of a mixture of Portland cement and Southampton dredge) there are placed concrete blocks, which are mainly 14 ft. long, 7 ft. 6 in. breadth, 6 ft. depth, weighing 43 tons. The outer blocks, facing the sea, are protected on the outsides with red granite blockers of a depth of 12 to 30 in., and average length of 13 in. and breadth of 24 in. The facing blocks are set header and stretcher, and at every 42 ft. 3 in. these blocks are tied together by means of a cross wall of blocks, and the pockets so formed are filled in with concrete *en masse*. There are four tiers of blocks, the upper one having a recess in it for a granite coping stone of 3 ft. 6 in. breadth by 2 ft. 1 in. in height, the weight of the coping tier of blocks is about 32 tons. At the centre line of the pier a subway is provided, 6 ft. deep, 4 ft. wide, so that in the worst weather there can be ready access to the lighthouse, which will be erected on the end of the pier when completed. On each side of the promenade a double iron hand railing and stanchions are fitted, and this is being done as shown on the model, as the pier progresses as well as the gas lamps which are fitted with reflecting tops. It has been incidentally mentioned that the Lucigen light is being employed. This patent light has already been described in our columns. It is obtained by forcing compressed air, in combination with creasote oil, through suitable burners, and it has been found that the cost of two lights, each of 2,000 candle power, is little more than four-pence per hour.

The block setting radial crane deserves special mention, and the working model of it exhibited is worthy of great commendation, having been constructed, as have all the principal models, by the River Wear Commissioners own employés. A brief description of the crane may not be without interest. It was designed by Mr. H. H. Wake, C.E., the engineer to the Commissioners, and all the Goliath frame work, which is of pitch pine and greenheart, and the gear upon which the booms rest and travel, were constructed in the River Wear Commissioners' works. The girder work of mild steel was made and erected by the North-Eastern Marine Engineering Company, Limited, Sunderland, and the hydraulic machinery by Messrs. J. Abbot & Co., Limited, Gateshead-on-Tyne. The crane is capable of lifting of 50 tons, and has been tried with a load of 67 tons, although concrete blocks, weighing as much as 45 tons are the heaviest that it has yet been required to lift, in ordinary practice. As is most necessary there has been provided a large factor of safety in all the girder work, chains, blocks and wearing parts. The crane rests upon a Goliath framing, upon which it is free to travel. The whole of the motive power is hydraulic, the pressure being supplied by an engine and four sets of pumps placed at the tail of the crane, which radiates on rollers by means of two hydraulic rams under the booms. The lifting and lowering of the blocks is effected by three cylinders and rams on the top of the booms, and to meet varying loads, the pressure can be put either on one, two or three of the rams. The travelling in and out of the "monkey" is controlled by two rams and cylinders fixed to the side of the booms. All the cylinders and engines are placed so as to act as part of the balancing weights required for the crane. The length from the pivot of this crane to the outmost position of the blocks is 109 ft., and the working of the crane and its stability have been found to be most satisfactory.

Allusion has been made to the s.s. *Quiam*. The River Wear Commissioners also on this stand exhibit a well finished model of this craft, the hull of which was built to their order by Messrs. John Blumer & Co., shipbuilders, North Dock, Sunderland. The *Quiam* is of the following dimensions:—Length, 138 ft.; breadth, 35 ft.; depth, 10 ft.; and it is provided with two wells, one capable of containing 100 tons of concrete and the other 50 tons. This vessel has been specially designed for the work of laying the deep-water foundations of the new piers at Sunderland, and to ensure quick manœuvring powers, &c., is provided with twin-screw propellers 5 ft. in diameter. The marine engines and hydraulic gear for lowering the concrete bags &c., have been constructed by the North-East Marine Engineering Company at their Sunderland works. The marine engines are compound surface condensing, 11 in. and 20 in. cylinders, 18 in. length of stroke. The designs of the concrete bag lowering barge were prepared and patented by Mr. H. H. Wake, C.E., and the vessel and machinery has been constructed under his supervision.

Another interesting exhibit is the model of the dredger *Wear*, on a scale of ⅜ in. to the foot. This dredger was constructed by Messrs. Hawks, Crawshay & Sons, Gateshead, and is open-ended, the buckets being so arranged as to be capable of excavating 12 ft. 6 in. in advance of the hulls. It is provided with an engine of 70 N.H.P., and the amount of material that can be loaded by this dredger into barges is 7,000 tons per diem. This model can be seen at work, the motive power being electricity. Alongside the last mentioned is the model of an ordinary hopper barge capable of containing 400 tons of dredging. There is also a model, on the scale of one inch to the foot, of a locomotive engine, complete in every detail, and in every respect a working model. This is shown on the model pier already described. The presence of this locomotive reminds the writer that the present works being carried on at the mouth of the river Wear are very extensive, giving constant employmemt to upwards of one hundred and fifty men. The foundation block of the Roker Pier was only laid in September 1885, and in one year about 1,000 feet of the pier was completed. Before commencing this pier, a sea wall was built extending from the old one to the limits of the northern boundary of the River Wear Commission. The working plant necessary for carrying out the various operations are fully indicated on the large model of the harbour, first described. It has been laid down so as far as possible to dispense with manual labour. Three locomotives, built respectively by Messrs. Manning & Wardle, Messrs. R. & W. Hawthorn, and Messrs. Dick Kerr & Co., are employed on the works. Two of these are of the ordinary gauge, 4 ft. 8½ in., and the third, of 1 ft. 8 in. gauge. The latter locomotive is employed in conveying the material for the block making yard, and runs upon two platforms with overhead railways. An iron 50-ton steam Goliath crane, by Messrs. Ellis of Manchester, is used for the purpose of loading the concrete blocks upon bogies, which travel on a central railway. These blocks are made on each side of the platform. For preparing the concrete there is a large workshop capable of turning out 100 tons per hour. In this the Portland cement and ballast or gravel is mixed, the material being lifted by dredging buckets into measuring hoppers. After being mixed, the concrete is, by a well arranged plan, dropped through large shoots into railway waggons for transporting to the spot where the concrete block or bag is to be formed. The mixtures used for the bag foundation purposes are: Of Southampton dredge, four parts; of gravel and sand, two parts; to one part of Portland cement. For the outer courses, eight parts to one part of Portland cement, and for the liquid concrete between the blocks twelve parts to one part of Portland cement are the proportions. In the latter case, granite rubble is used to a large extent, being embedded *en masse* along with the gravel and sand. It must be understood that the pier is practically one solid mass of concrete, no loose filling up being adopted, as is often the case, it having been deemed advisable to use concrete of somewhat inferior quality, as being much more effective in supporting the outer course, and at the same time, entailing very little additional expense. This lengthy reference to the exhibits of the River Wear Commissioners has been made as the whole of their models refer to work at present in hand, and as the major portion of their exhibits have been made specially for the Newcastle-on-Tyne Exhibition.

The Italian Government have a large collection of models of ancient and modern vessels exhibited in the North Court, mostly

placed *vis-a-vis* to the large stand devoted to the principal naval architectural exhibits of Sir Wm. Armstrong, Mitchell & Co., Limited. These Italian models were at the Liverpool Exhibition of last year, but did not arrive and get unpacked until after the middle of June, when we had completed our notes for the article "Among the Models," which was so favourably received. H. F. Swan, Esq., having the present exhibition at Newcastle-on-Tyne in view, in his capacity as chairman of the Naval section, applied and obtained permission to re-exhibit them this year; and in the meantime the models have been stored at Elswick. It is apparent that Mr. Swan exercised a wise discretion in securing this immense collection of models. From several points of view they may claim to be the most interesting Naval architectural exhibits. Not only are there included a number of representations on a small scale of the oldest types of vessels, there are also several models fully illustrative of the details of constructive iron shipbuilding, as practised in the Italian war vessels. These exhibits also are about the sole ones to give, though it be but in a minor degree, an international character to the exhibition. It will probably be generally granted that the most important model in the Italian collection is that of the armoured barbette twin-screw protected vessels *Italia* and *Lepanto*, which shows the internal arrangements and construction, including boilers, steering gear, guns, &c., and on one side the completely finished hull plated and rivetted, and partially sheathed with wood and zinc. This model is only one of a number which are partially constructed, identically as in the case of the actual vessel, and are thus of a character rarely or ever made by British shipholders or model makers. Evidently labour in Italy must be cheap when such an amount of it is expended over constructing miniature vessels. As we made a very brief reference to these vessels, *Italia* and *Lepanto*, *apropos* of another model of them exhibited at Liverpool by their builders, Orlando Brothers, of Leghorn, showing her launching arrangements, a further account will be of interest. The leading dimensions are: Length (pp.), 400 ft. 6in.; breadth extreme, 72 ft. 9 in.; depth, 53 ft. 9 in. The draft of water was designed to be—forward, 25 ft. 6in.; aft, 30 ft. 6 in.; but the draft of water is given in Lord Brassey's "Naval Annual" as 31 ft. 2 in., and displacement 13,851 tons. The same authority says these are the largest armoured ships in the world, and will probably be the fastest as well as the most powerfully armed. As the steam trials of the first of these vessels are not completed, although launched some years ago, the actual maximum performance of the engines, and the corresponding speed cannot be given, but the I.H.P. is given in the "Naval Annual" as 18,000, and the speed as 18 knots per hour. The buoyancy and stability of these ships are not attained by side armour, there not being even a short belt of armour. But in addition to a vast and well-devised cellular construction at the water-line, there is a very large quantity of thick internal armour protecting the passages and gun mechanism. The armour on the citadel is of compound iron and steel 19 in. thick, with a backing of 22¾ in. An armoured deck below water takes 1,200 tons of plates, the ammunition shaft leading to the citadel 250 tons, and protection to the funnels 550 tons. There have been several changes in the arrangements of armour and armament of these vessels since they were first designed, but, according to the "Naval Annual," the latter consists of four 110-ton guns of 43 centimetres calibre, breechloading and rifled Armstrong guns, which are placed in the citadel, and 32 ft. 8 in. above the level of the water-line. The revolving platforms within the citadel for the 100-ton guns, are worked by hydraulic power, as arranged by Mr. George Rendel. There are also eight 15 centimetre calibre guns of the same description as the large ones, six light guns, and 14 machine guns, in the *Italia*, the *Lepanto* having two additional 15 centimetres, and two less machine guns, and both vessels four torpedo tubes. The engines of these vessels were designed and built by Messrs. John Penn & Sons, and consist of two sets of three cylinder vertical inverted type to each of the screw propellers, which are 19 ft. 6 in. diameter, making 12 cylinders in all. The boilers are 26 in number, with three furnaces each, 12 being placed aft of the engines, at such a height as to allow the screw-shafts to be fitted below them, the total grate area being 1,521 square ft. The length of the hulls of these vessels occupied by engines, coal, and boilers, is not less than 250 ft. The coal supply carried normally stands at 1,650 tons, and the distance that can be steamed at a speed of 10 knots per hour is 8,900 knots. Another model of almost equal interest is that of the mastless armoured turret iron ships *Duilio* and *Dandolo*. The former was commenced at Castellamare in 1872, launched in 1876, and made her trial trip in January, 1880. The *Duilio* and *Dandolo* are of the following dimensions:—Length (b.p.), 340 ft. 11 in.; breadth (extreme), 64 ft. 9 in.; depth of hold, 21 ft. 11 in.; draught of water, 26 ft. 7 in.; displacement at the same being 10,570 tons. The ram on the stem projects 9 ft. forward of the perpendicular line, and is immersed 14 ft. There are two revolving turrets containing four 45 centimetre 100-ton muzzle-loading rifled Armstrong guns, and the remaining armament is six light boat, and twelve machine guns. The turrets are protected by 17 ¾-in. iron armour plates, with 12 in. teak backing. The hulls of these vessels are of iron and steel, on the cellular system; a double bottom, extending for upwards of 230 ft. in length, is divided into numerous compartments, there being a total of 102 in each vessel, with all usual pumping arrangements. About amidships there is a central armoured citadel or compartment 107 ft. in length and 58 ft. in breadth, which descends to 5 ft. 11 in. below the water line. Forward and aft of this citadel, the decks, which are 4 ft. 9 in. under water, are defended by horizontal armour. Over this citadel is built a second central armoured compartment, which encloses the bases of the turrets and the remaining portion of the mechanism employed in loading and working the guns. Lastly, above this second compartment rise the two turrets; these are placed at each end of the armoured citadel, not in an even line with each other, but diagonally at opposite corners of it, with the centres at the distance of 7 ft. 8 in. from the longitudinal centre line of the vessel, so that one turret is on the starboard side and the other on the port side. The armour on the central portion of the vessel is 21·65 in. in thickness, resting on about 24 in. backing; on the upper redoubt, 17·71 in. thick on 20 in. backing. It is interesting to note that in the *Duilio* the engines (twin-screw) are of the ordinary surface-condensing type, and in the *Dandolo* they are compound; in both instances the engines being constructed in this country, in the former vessel by Penn, and in the latter by Maudslay. The cost of the last-mentioned vessel is given in the "Naval Annual" as £700,000, the I.H.P. of the engines of both vessels as 7,500, and the speed 15 knots per hour. The normal coal supply is 1,279 tons, and the distance that can be steamed at 10 knots an hour is stated to be 3,760 nautical miles.

The next Italian model we notice is that of the protected cruiser *Flavio Gioja*. This vessel is a corvette of 2,533 tons displacement, built of steel and launched in 1881. The length, 255 ft. 11 in.; breadth, 42 ft. 7 in.; mean draught of water, 17 ft. The engines of this vessel indicate 5,000 H.P., giving a speed of 15 knots. There is no armour plate protection to this vessel, and the armament consists of eight 15 centrimeters breechloading rifled Armstrong guns, besides three lighter and six machine guns.

There are more recently built vessels of the protected cruiser type represented by their models. The *Savoia* was built of steel in 1883, and is of the following dimensions:—Length, 275 ft. 6 in.; breadth, 42 ft. 7 in.; depth, 28 ft. 2½ in.; the mean draught of water, is 17 ft.; with a displacement of 2,850 tons. The I.H.P. of the engines, the vessel having only one propellor, is 5,000, and the speed of the vessel 15 knots an hour, and the armament includes six 15 centimetres breech-loading rifled Armstrong guns.

The *Giovanni Bausan* is also represented here by one of these constructed models which witness to the patience of the Italian workmen. A further notice of this vessel will, however, be superfluous as it has already been described in this series of articles so merely add that she was built by Sir W. G. Armstrong Mitchell & Co., Limited.

Quite a contrast to the last mentioned is the model of the iron protected torpedo cruiser *Pietro Micca*, built in 1876, which on a displacament of 535 tons, and with an I.H.P. of 972 is only credited in the "Naval Annual" with a speed of 7 knots per hour. Strangely the official catalogue of the Exhibition omits the speed and gives 1,460 as the I.H.P.

Another type of vessel is represented by a half-model, the *Andrea Doria*, the *Francesco Morosini*, and the *Ruggiero di Lauria*. They have an armoured barbette citadel of compound 17¾ in. plates, the axis of which makes an angle of 30° with the keel line. In the citadel four 110-ton breech-loading rifled Armstrong guns are mounted on two turrets which are unarmoured, and the guns may therefore be said to be *en barbette*, although they are covered by bullet proof shields. The hull above the armour deck, which is beneath the water line, is cellular, and the principal dimensions are:—Length, 328 ft.; breadth, 65 ft. 4 in.; depth, 36 ft 9 in. The mean draught of water is 27 ft. 2 in. and the displacement 11,000 tons, according to the "Naval Annual." The last mentioned of these three vessels was launched in 1884, and the others in 1885. They are all fitted with twin-screws, and the

engines indicate 10,000 H.P. giving a speed of 16 knots per hour. The normal coal capacity is 850 tons, and the distance that can be steamed at half-speed is given as 4,500 nautical miles. The armament is, as usual in the Italian Navy, very powerful, consisting, in addition to the four large Armstrong guns already mentioned, of twelve fifteen centimetres breech-loading Armstrong guns, and six seven-and-a-half centimetre guns of the same type, as well as lighter and machine guns, and three torpedo tubes.

The model of the iron armoured turret ram *Affondatore* is also of some interest, being built in 1866 by the Millwall Shipbuilding Company. This vessel has been described as a double turret ram, of a displacement variously stated at figures varying from 4,100 to 4,376 tons and is of the following dimensions:—Length, 293 ft. 9 in.; breadth, 40 ft.; depth, 28 ft. 9 in. The engines are of 3,240 I.H.P., and the speed of the vessel 13 knots an hour. The normal coal supply is 460 tons, and the distance that can be steamed at 10 knots, is 1,647 knots. The armament includes two 25 centimetre breech-loading rifled Armstrong guns, and the armour plating on the turrets is five inches in thickness, as also is the belt. The cost of the *Affondatore* is given by Lord Brassey, in the "Naval Annual," as £152,480.

An earlier type of vessel one of the iron armoured broadside ships, we see in the *Maria Pia*, whose armour-plating is of a *maximum* thickness of 4½ in.

There are also three models of despatch vessels. The iron built *Rapido* of 1,456 tons displacement, with engines of 1,920 I.H.P. attaining a speed of 13 knots an hour, built in 1876. The *Staffetta*, built of the same material in the same year, of 1,505 tons displacement, with twin-screws of 1,800 I.H.P. which is credited with a greater speed, 15 knots, by the "Naval Annual" than the more heavily powered *Rapido*. If these figures be reliable, the results appear to speak volumes for twin-screw steamers. The *Agostino Barbarigo* is a much smaller vessel, and proportionately, with extraordinary powerful engines. The displacement of this latter vessel is only 656 tons; the I.H.P., 1700; and the speed 15 knots, according to Lord Brassey's useful work the "Naval Annual." All the last three mentioned vessels are armed with Sir William Armstrong's breech-loading rifled guns, and have varying cruising capabilities on their normal coal supply, extending from 1,000 to 3,300 knots, at the speed of 10 per hour. The numerous models of wooden war vessels—gondolas, very interesting in their way—the fully manned galleys, with their representations of all their crews, numbering in one case over 150 men—we must *per force* pass over with the remark that they are interesting historical studies, as they range back step by step to the fifteenth century. To the thoughtful visitor these exhibits will only emphasize the nature of the mighty and various transitions that the whirligig of time has wrought, and possibly cause him in his reflections to endeavour to prognosticate the developments that await navigation in the future, when iron and steel have been displaced by some more durable and lighter material, and steam has been annihilated by electricity or some force of nature yet awaiting the patient research of an indomitable discoverer.

Messrs. Chadburn & Son, 11, Waterloo Road, Liverpool, 69, Anderson Quay, Glasgow, and 105, Fenchurch Street, London, whose name is known to every marine engineer, have one of the best arranged and most effective displays of exhibits in the North Court. It would be only attempting to "gild the lily and adorn the rose" to speak in terms of commendation of the specialities of this firm in engine telegraphs, alarm gongs, &c., as they have deservedly a world-wide renown, and as they have obtained exhibition awards at London, Paris, North-East Coast, Amsterdam, The Fisheries, Antwerp, and Liverpool. Should an award for this class of engine-room outfits be given at Newcastle, it may be safely affirmed that Messrs. Chadburn and Son will again be the recipients. We need therefore not trouble our readers with a detailed description of their engine, steering, docking, and torpedo boat telegraphs, tell tales, alarm gongs, &c., but would call their attention to their latest novelty, the "patent direction and revolution indicator," which shows at a glance the direction and speed of the engine shafting. So that our description may be complete, we give in Fig. 1 the reproduction of a photograph of one of these indicators. They have a manifest advantage over a mechanical counter, as no calculation is necessary to arrive at the speed of the engines, and they should meet with the special approbation of owners and [illegible] are desirous of t[illegible] "bridge" knowing with [illegible] accuracy how [illegible] "stoke-hole" is doing its d[illegible] [illegible]tration there be seen two pointers, the o[illegible] revolving wit[illegible] gearing from the engine sha[illegible] shows the n[illegible] of revolutions per minute a[illegible] [illegible]s are trav[illegible]

This direction and revolution indicator is constructed in the most approved manner, and in accordance with the principle of "the resistance of a fan against the air," so that in adopting it, there need be little fear of its becoming defective. Already a number have been supplied to steamers, the British and foreign navies, and it only requires to be better known by shipowners and superintendents to come much more generally into vogue; and we trust the patentees, Messrs. Chadburn & Son, will be amply rewarded for their enterprise and skill in producing such a useful instrument.

FIG. 1.

Turning down the northern central avenue of the North Court the first stand on which there are objects generally interesting to our readers is that of Elliott's Metal Company, Limited, Selly Oak Works, Birmingham, and Pembrey Copper Works, South Wales. We believe this is the only firm which is extensively engaged in each of the three great branches of the metal trade, viz., copper, yellow metal, and brass. Amongst the many specimens of copper, we single out three plates for a locomotive fire-box—tube plate, door plate, top and side plate (in one) 15 ft. 6 in. by 6 ft. by ⅝ in.; a sheet 16 ft. by 7 ft. 4 in. by ½ in.; a raised bottom 7 ft. 6 in. diameter; a pan 6 ft. diameter by 3 ft. deep; round and square bars, sheets and circles of various sizes; a coil of high conductivity telephone wire, 134 lbs., in one length of 2,300 yards without joint of any kind, and tubes both brazed and solid drawn of all sizes likely to be used for any of the multifarious purposes to which copper is applicable. We observe that the yellow metal items include a condenser tube plate 8 ft. 6 in. by 5 ft. 3 in. by 1½ in.; another one for a *triple effet* sugar pan, 7 ft. 6 in. diameter by ⅝ in. thick; two pump rods, one of them so large, [illegible]ter by 15 ft. long about 15 cwt.) that we prefer to call [illegible]lts, sheets and sheathing, screw bolts and nuts, &c., [illegible]ecimens comprise solid drawn tubes for locomotive [illegible]ilers, for surface condensers, and other purposes; we [illegible]n. bore by 22 ft. long gas tubes; sheets plain and [illegible]t and pin wire; roll brass of various widths and The production of brass sheets is the result of a cold

process, and consequently in the case of large ones such as the one 6 ft. by 4 ft. 6 in. most tedious and costly.

Certainly extremes meet here, for while on one hand we have articles considerably over a ton in weight, on the other we have metal rolled so thin that 250 thicknesses go to an inch, and wire only $\frac{1}{8}$ of an inch in diameter.

We have no hesitation in pronouncing this the most complete and varied exhibit of its kind that has ever been submitted to the notice of engineers and the public generally.

Although we endeavour to cater principally for Marine Engineers, and others entrusted in shipbuilding and allied industries, we cannot pass over in entire silence the many superb and magnificent exhibits illustrative of locomotive engineering, which certainly rival, if they do not, as the marine engineering exhibits do, surpass those at the Liverpool Exhibition last year. An exhibit that it falls to our lot to mention in connection with the great railway companies represented at this Exhibition, is not a recently constructed engine, but that of the "Locomotion" and no doubt it has already been viewed by ten thousands of visitors, and will be by as many more, with unbounded interest. It well may be, seeing that its presence supplies a link connecting the present development of locomotive engineering with its first conception. The "Locomotion" was the first engine on the Stockton and Darlington Railway and was built in 1825 by the renowned railway engineer George Stephenson, at Newcastle-upon-Tyne. This engine has often been described, so at the present time we will only give the principal particulars, as it will be interesting to contrast them with the locomotive engines of the present time. It has two vertical cylinders of 10 in. diameter originally 9 in., having a stroke of 24 in. and an estimated H.P. of 16, its weight in working order being $6\frac{1}{2}$ ton, and it attained a speed of 8 miles an hour. The boiler is 10 ft. in length, 4 ft. in diameter, with a through flue 10 ft. long, 2 ft. diameter, The total heating surface of the boiler is 60 sq. ft. and the diameter of the chimney $17\frac{1}{2}$ in. The locomotive has four wheels, called plug wheels, which are 4 ft. diameter; while the tender has four wheels 2 ft. 6 in. in diameter, and is 10 ft. 6 in. long, and weighs empty $1\frac{1}{2}$ tons, having a square tank, which contains 240 gallons of water. The accommodation for coal allows $1\frac{1}{2}$ tons being carried. An old coal waggon is also attached to the rear of the tender, and it will be noticed the coupling consists of merely a flat bar.

Next we come to the Express Passenger Engine and Tender, exhibited by the Great Northern Railway Company. This engine has cylinders 18 in. diameter, of 28 in. length of stroke, and was designed by Mr. P. Stirling, and built in the Great Northern Railway Company's workshops at Doncaster. Its drawing wheels are 8 ft. 1 in. in diameter, and altogether this engine and tender forms a most striking contrast to the "Locomotion" just described. It is needless to say that this Great Northern express engine is in every respect admirably built and finished, and forms a most imposing and magnificent exhibit.

Several Tyneside firms also exhibit locomotive engines which we may find space to allude to later on. Besides the exhibits of the North-Eastern Railway Company referred to in our July number, there are also exhibited a number of portions of the compound passenger and goods engines, which have been designed by Mr. T. W. Worsdell, including high and low pressure cylinders cast together, and a steel crank axle, with circular cheeks, fitted with valve gear, as applied to these engines.

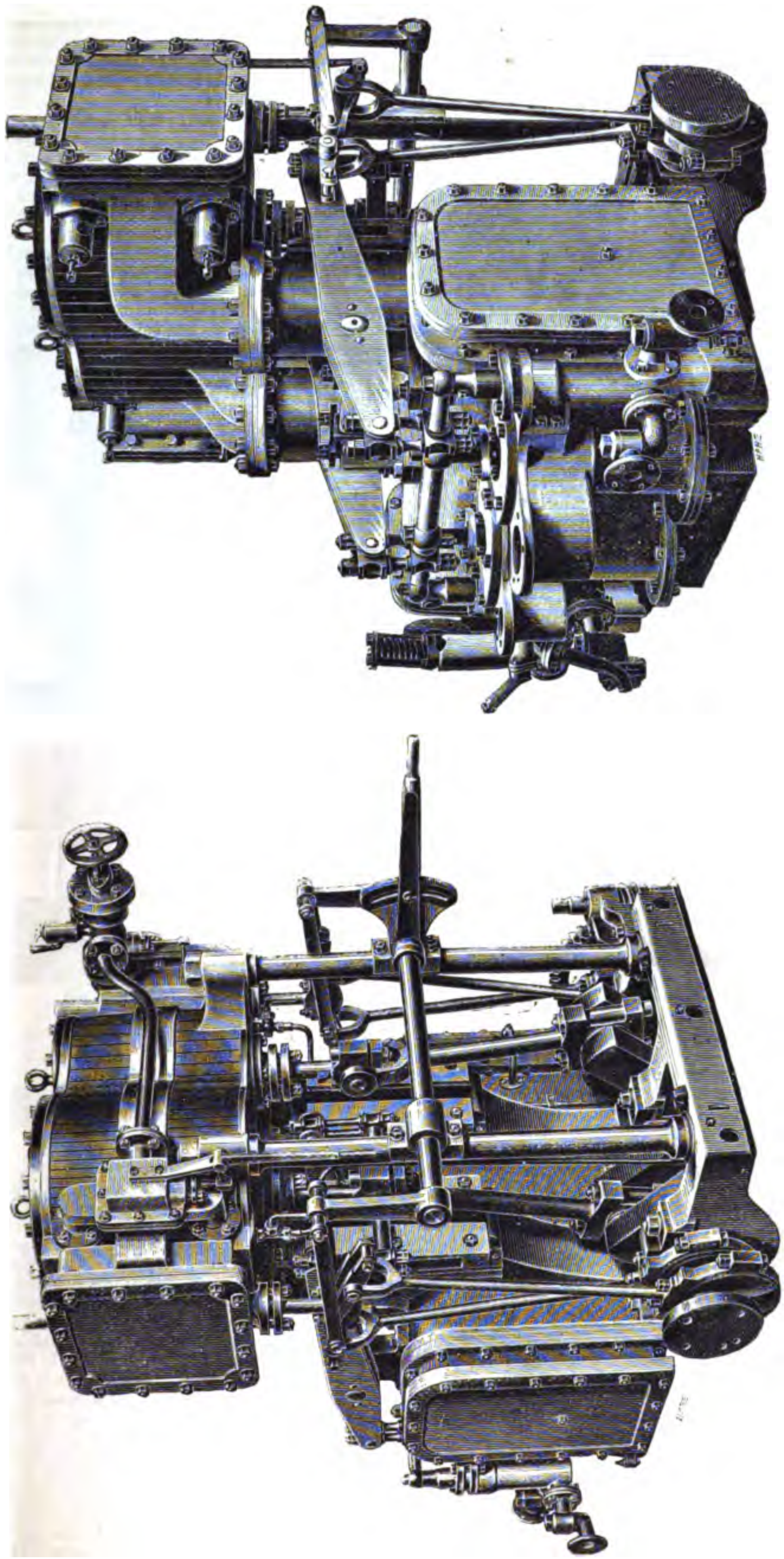
Passing by the reversible tramcar, &c., exhibited by the Ashbury Railway Carriage and Iron Company, Limited, of Manchester, and only glancing at the crucible steel castings, besides a collection of all kinds of engineering castings, in the same neighbourhood we see Mr. Wasteneys Smith's stand, to which we have already drawn attention, and adjoining which is a large collection of iron and steel exhibits, contributed by the Barrow Hœmatite Steel Company, Limited, of Barrow-in-Furness.

The Barrow Steel Company stands apart in being the only exhibitors from the enterprising town on the west coast, and one of the few from that part of the country. It need not be stated that the representations of their manufactures are of a high-class character, as this company has attained a high repute, both at home and abroad, nor will it be necessary to weary our readers with a mere reiteration of how this Company has attained its present position. We are, however, reminded by the various ores and samples of pig-iron exhibited in a handsome glass showcase, of the natural advantages of the district surrounding Barrow-in-Furness, in having a large supply of hœmatite iron mines. Among the many exhibits we observed Spiegel Ferro-manganese, and Swedish iron; and to those who wish to refresh their memories or instruct themselves as regards the possibilities of steel, an inspection of the cold twisted steel angle bars should not be omitted. The two specimens of steel plates bulged by the explosion of dynamite are interesting, and although the plates are dished out for a considerable distance there are no signs of fracture. The exhibits illustrative of the manufacture of tin plates from Barrow steel are also of interest, hard sheet, close annealed, cold rolled and close annealed, cold drawn, pickled and close annealed, as well as a number of sheets of finished tin plate are exhibited, and several small articles made out of the tin plates. Steel wire nails, railway bars *en galores*, twisted and tested variously, the front plate of a boiler of the Lancashire type, and a number of tests of steel are included amongst this Company's exhibits. A test we noted gave 27·05 tons per square in. breaking strain with 112·5 % elongation.

The Leeds Forge Company occupy the next stand, and they have been fortunate in the position they have secured, as their exhibits are readily visible from three points of view. The manner in which they have arranged the samples of their manufacture, lends an imposing aspect to their stand. In addition to exhibiting three of Fox's patent corrugated boiler furnace tubes, a kind of pyramid is formed by four of Fox's patent flanged frame plates for railway engines, about 22 ft. in length, which have been made at one heat by a special hydraulic press. The Leeds Forge Company also exhibits Fox's patent corrugated tire, which has been devised to prevent skidding when tram lines are being crossed at an angle.

Messrs. Baird & Barnsley, of Bull Ring Engine Works, North Shields, exhibit a pair of compound-engines suitable for a yacht, fishing or small cargo vessel, of which we give two illustrations, the first showing the back view of the engines and the second their appearance from the starting platform, both being reproductions of photographs of the engines as they are to be seen in the Exhibition. As will be seen these engines are a pair of ordinary compound surface condensing inverted cylinder screw engines. The high-pressure cylinder is 12 in. diameter, the low-pressure cylinder 23 in. diameter, and the length of stroke 1 ft. 4 in. The cylinders are very close together, and the steam chests with the connection for exhaust from the high-pressure cylinder to the low-pressure cylinder steam chest are all in one casting, making them very snug, and economising space, a *desideratum* of no small importance in vessels of a small type. Two pair of engines identical with those exhibited have been previously manufactured by Messrs. Baird & Barnsley, and were fitted in the fishing screw steamers *British Prince* and *Danish Prince*; and have given every satisfaction. It may be of interest to our readers to have the leading particulars of these fishing vessels. They are 76 ft. in length over-all, 17 ft. breadth extreme, 8 ft. 6 in. depth, and are constructed of wood, carvel built, and are fitted with two lowering masts with a good spread of canvas. The engines indicate 90 H.P., and the vessels have a mean speed of $8\frac{1}{2}$ knots under ordinary circumstances. The engines exhibited by Messrs. Baird and Barnsley are very creditable to their makers, and in front of them the visitor will see a small electro-plated model of the *British Prince* and *Danish Prince*. The following are additional particulars of the engines, which we anticipate will be interesting. The condenser is fitted with 244 solid drawn brass tubes 4 ft. 1 in. long, $\frac{5}{8}$ of an inch in diameter, having a total cooling surface of about 200 square ft. The air pump, driven from a lever as usual, is $9\frac{1}{2}$ in. diameter and half the stroke of the main engines. The circulating pump is similarly arranged and is $7\frac{1}{2}$ in. diameter, and the feed and bilge pumps are each $2\frac{3}{4}$ in. diameter, and all are 8 in. stroke. The crank shaft is $4\frac{5}{8}$ in. diameter and is of the best forged scrap iron, every care having apparently been taken to have the whole of the forgings and castings in these engines of the most reliable description. The pistons are fitted with ordinary wave springs, which have been found to prove satisfactory in this type and size of engines. The propellers fitted to the *British Prince* and *Danish Prince* were 6 ft. 10 in. diameter, 9 ft. pitch, having a total blade surface of $7\frac{3}{4}$ sup. ft. The boilers of these vessels are constructed of Siemen's-Martin steel and are of the ordinary circular multitubular marine type, 7 ft. 6 in. diameter, 8 ft. 2 in. long, having two furnaces 2 ft. 5 in. diameter and 5 ft. 9 in. long. The tubes are $3\frac{1}{4}$ in. external diameter, 52 in number, and the total heating surface above the grates is 395 sup. ft. The working pressure of the steam is 85 lbs. per square in. the boiler having been tested to 170 lbs. by hydraulic pressure. Messrs. Baird and Barnsley deserve credit for the excellency of finish and workmanship displayed in the pair of marine engines which we have illustrated and described, as well as for the compactness attained in the arrangements, combined with accessibility to the working parts.

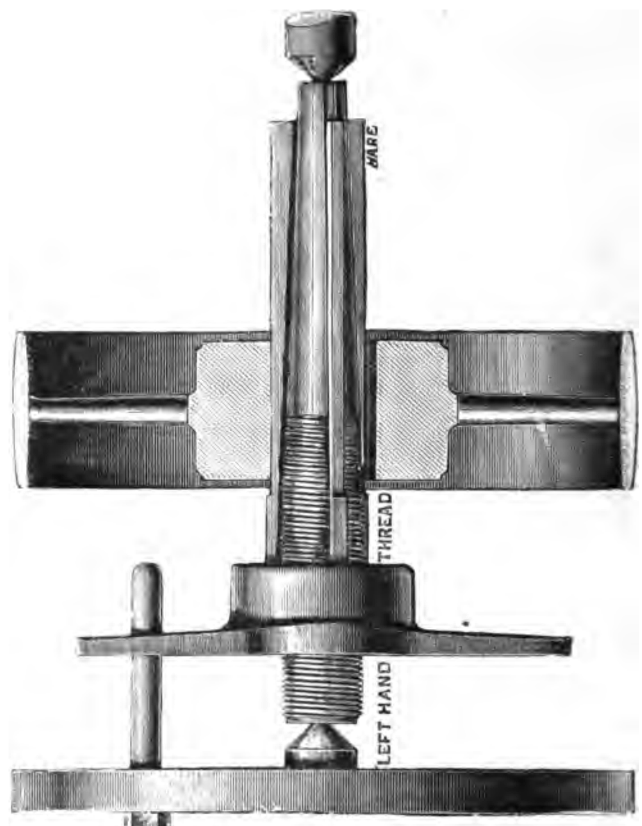
Messrs. Alex. Shanks & Son, Engineers, of Dens Iron Works, Arbroath, and 27, Leadenhall Street, London, exhibit in the



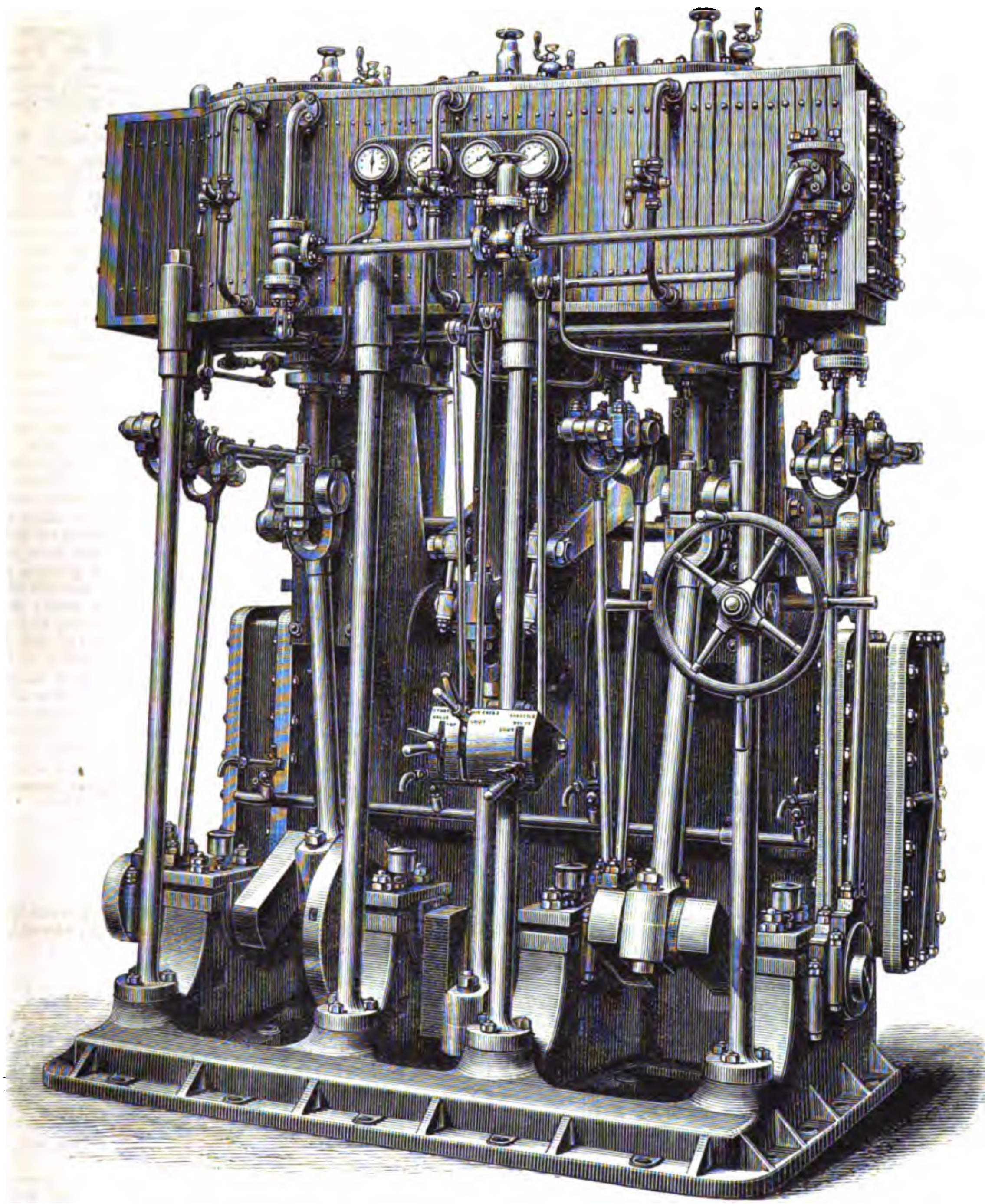
BAIRD & BARNSLEY. (For Description see page 160.)

West Court, a set of triple-expansion inverted cylinders, surface condensing marine steam engines, fitted with all the latest improvements, of which we give an illustration showing the front view from the starting platform. The high pressure cylinder is 10 in. diameter, the intermediate cylinder 15 in. diameter; and the low pressure cylinder 24 in. diameter, all having a stroke of 18 in. The cylinders have been cast of a special mixture of hard grey cast iron, with escape valves at top and bottom, placed well outside the lagging. Drain cocks are fitted into each of the cylinders, with drip pipes attached for leading the condensed water into the bilges or condenser, and a complete set of indicator gear is attached to each of the cylinders, which are lagged with hair felt and covered with polished mahogany. The pistons are of the same metal as the cylinders, cast hollow with strong connecting ribs, and each of them is fitted with two metallic packing rings. The cylinder covers are of strong cast iron, with strengthening ribs on the top sides, polished on their edges and faces; the recesses being lagged with hair felt and covered with polished mahogany. The starting valve is on the piston principle. is single ported and partially balanced, and is fitted to the low pressure cylinder, the lever for operating the valve being brought within easy reach of the reversing wheel. The slide valves are of the ordinary kind and of the same metal as the cylinders; the high-pressure and the intermediate pressure valves being single ported and the low-pressure double ported. The steam chest door of cast iron, strengthened with ribs, is lagged and covered the same as the cylinders. The bed plate is of box form, having four bearings, the crank shaft bushes having round bottoms, held in their places by wrought iron covers and through bolts and nuts. The surface conden'er forms part of the standards at the back of the engine, and is fitted with horizontal brass tubes $\frac{3}{4}$ of an inch external diameter and No. 19 B. W. G. in thickness, arranged for the circulating water to pass through them, the steam being condensed on the outside. The tube plates are of Muntz metal $\frac{3}{4}$ of an inch in thickness. The tubes are fixed with wooden ferules and have a total cooling surface of 365 square ft. The air pump is single acting and worked from a sway lever connected to the intermediate piston rod crosshead, the pump barrel being of gun metal $\frac{3}{8}$ in. thick, 12 in. diameter, 9 in. stroke. The bucket, valve seats, guards, all bolts and studs which come into contract with the water and pump rod are of gun metal. The circulating pump is double acting and operated in the same manner as the air pump. The pump barrel is gun metal $\frac{5}{16}$ in. thick, 8 in. in diameter, with 9 in. stroke. The bucket, valve seats, guards, &c., are all of brass, a complete set of snifting and other valves being provided. The feed and bilge pumps are each $2\frac{7}{8}$ in. diameter, single acting, worked from the air pump cross-head. The plungers, valves, and valve seats are of brass, and an escape valve and cast iron air vessel is provided. The back standards for supporting the cylinders are of box form, cast along with the condenser, of good clean cast iron. The front standards, four in number, are of wrought iron $2\frac{1}{4}$ in. diameter. The back columns are provided with loose cast iron guides to suit the cross-head slippers. The piston rods are of hammered steel $2\frac{5}{8}$ in. diameter, fixed to the pistons by tapered ends, with nuts on the top side of pistons. The cross-heads are forged solid with the piston rods, and are provided with gun metal slippers 12 in. long, $6\frac{1}{2}$ in. wide. The connecting rods are of the best hammered scrap iron two and a half times the length of the stroke from centre to centre, and $2\frac{1}{2}$ in diameter at the smallest part, tapered from end to end. The forked ends are provided with steel cross-head pins securely driven into the eyes and the bottom ends are provided with gun metal bushes. The slide valves are worked by link motion, having cast iron eccentric pulley, gun metal straps, wrought iron rods and links, the valve spindles being of steel and having guides at the top. The top end of eccentric rods, eyes of valve spindles and sliding blocks are provided with gun metal bearings with suitable provision for adjusting. The distance from centre to centre of eccentric rods at the links is 9 in., the latter being provided with double drag links, those for the high-pressure having screws and nuts to enable the cut off in that cylinder being changed. The reversing gear is worked by a hand wheel and double threaded screw. The crank shaft is of forged steel $4\frac{3}{4}$ in. diameter, in the journals, and is one solid forging, the cranks being set at angles to one another of 120 degrees. All the brass bushes are of the best gun metal, a complete set of lubricators, oil boxes, caps, pipes, and syphons being provided; the oil cups on the crank shaft being placed above the bearing. A hand turning gear is fitted consisting of a cast iron disc with holes and suitable hand levers. This set of triple-expansion engines has been constructed by Messrs. Alexander Shanks & Son, to work with a steam pressure on the boilers of 150 lbs. per square in. To secure the steam tightness of the glands &c., Morrison's patent asbestos packing has been adopted. It is unnecessary to add that in every detail, there is evidence of care having been exercised to turn out a first-class job, and we think it will be generally admitted this well-known firm of engine builders in this set of triple-expansion engines maintain their well-known character for excellence of design and finish.

The Britannia Company, of Colchester, are to the front with a large collection of their specialities. Their exhibits include an engineer's lathe 12 ft. long, which is self-acting, screw cutting, and surfacing; also a screw cutting lathe with chucks and tools 4 ft. long, and a similar one 3 ft. in length, besides a number of small lathes for amateurs. A new patent treadle saw, which works at 1,500 revolutions per minute and is specially adapted for pattern makers, should not be overlooked by visitors inspecting the exhibits of the Britannia Company, as it is one of the latest improved specialities of this company, having only been patented two years ago. We illustrate one of the exhibits most interesting to our readers which this Colchester company have on view at Newcastle. It is Noble's expanding mandril, and is made of



steel with three grooves into which steel slides fit easily. In our illustration the slides are shown marked F. This mandril has a right-hand thread at one end, and a left-hand thread at the opposite end. The tightening nut B is also the driver, and as the tool comes into contact with its work it moves the driving nut and the three steel slides up the mandril, thus expanding the exact distance sufficient to ensure the article being held firmly. Each mandril expands from one-quarter to three-quarters of an inch, according to its size, but additional slides can be supplied, when desired, to expand double or treble the normal sizes, and by the additional slides intermediate sizes are provided. By unscrewing the nut C, by means of a spanner, the tightening nut B will unscrew at the same time, owing to there being both a left hand and right hand thread. There are evident advantages in Noble's expanding mandril, as pulleys, bushes, &c., can be fitted by this mandril in a moment, without fixing in a vice or hammering. The slides expand automatically, the deeper the cut of the tool the tighter the mandril holds, owing to the driver being also the tightening nut. One of the most important features of this mandril is that the slides always expand parallel



ALEX. SHANKS & CO. (For Description see page 162).

to the centres, by which true work is ensured, practically impossible with the old style of mandrils. Great economy of time is obtained by the use of Noble's expanding mandril, and they have been supplied to many eminent firms, as well as to the Royal Arsenal at Woolwich. Among the remaining exhibits of the Britannia Company we also noticed a new pattern gas engine of one man power, a large assortment of lathe tools and chucks, and a patent lathe carrier. Altogether our inspection of this company's exhibits was replete with interest.

Messrs. Samuel Tyzack & Co., Monkwearmouth Iron Works, Sunderland, have a varied display of steel and iron made by that firm for shipbuilding, engineering, and other purposes, including half-rounds, solid and hollow, tee-bars, angle-bars, bulbs, &c. There are also a number of novel sections of iron on this stand, which we feel assured will soon pass into general use in shipbuilding. They have been invented and patented by Messrs. Bell and Rockliffe, who are connected with the firm of Messrs. Samuel Tyzack & Co. The first of these novelties we call attention to is the combined hatch rest-bar and outside moulding, of which fig. 1 gives a representation. There have been sections of a similar kind rolled before, but in every instance they projected into the hatchway, and were liable to be damaged and to impede the discharge of cargo. As will be seen from our illustration, the moulding and rest-bar of Messrs. Bell & Rockliffe is entirely outside the hatch, and has, therefore, none of the objectionable features of other forms of combined hatch moulding and rest-bars. Another novelty being introduced by Messrs. S. Tyzack & Co. is rolled hatch battening cleat iron, also invented and patented by Messrs. Bell & Rockliffe. Hitherto cleats for hatches have been either forged from bar iron or have been cast, and often prove untrustworthy. There is no more frequent source of expense in connection with the deck in steamers and sailing vessels than the breaking of hatch cleats, largely arising from the inferior quality of the cleats, but also from the repeated wedging, which, if it does not break the cleats, frequently starts the riveting. This is mainly due to the use of large wedges, which exert their force on the extreme upper part of the cleat. In cleats formed of the section, shown in fig. 2, viz., Bell & Rockliffe's patent, this objectionable practice is effectually obviated, as only wedges of a moderate depth can be got in the gap, so that the strain is taken by the lower part of the gap. In connection with this battening cleat iron the same firm are introducing as a battening bar a novel section of angle-iron, one flange of which is corrugated, as shown in our illustration (fig. 3), designed to more effectually grip the tarpaulins, a purpose it appears admirably calculated to serve. Messrs. Bell & Rockliffe are also the inventors and patentees of numerous sections of patent mouldings for ships' bulwarks, rails, etc., and as their adoption would effect considerable saving in labour, more especially in riveting, they may be reasonably expected to come into general use in shipbuilding at an early date, and displace the present built up forms of iron bulwark rails. We illustrate five of these sections, which appear to be more especially likely to recommend themselves to the shipbuilding fraternity, the first of which it is anticipated will be the most popular; and we contrast with the first three of these patent sections the present method of obtaining a similar form of bulwark rails, so that at a glance our readers may see the manifest advantages of Messrs. Bell & Rockliffe's patents. Our illustrations, figs. 4 and 4A, 5 and 5A, 6 and 6A, require no explanation, Figs. 4A, 5A, and 6A being the methods of building up bulwark rails, as frequently practised, and figs. 4, 5, and 6, the patent mouldings of Messrs. Bell & Rockliffe; and all are shown attached to the bulwark plating. Figs. 7 and 8 show forms of bulwark rail mouldings designed to take the place of teak hand rails, as fitted to bridge, poop, and other open bulwarks, and which, besides being cheaper, will be more lasting, as they will not be damaged by the chafing of ropes, &c., as rails of teak are when not protected with brass or other chafing plates. We should not omit to draw attention that both at this stand and in the North Gardens a small full-sized hatch is exhibited complete with tarpaulins, rest bar, patent cleats, wedges, and corrugated angle iron battening bar, so that the sea-faring visitor can readily satisfy himself of the practicability of Messrs. Bell & Rockliffe's patents, as applied to hatches, and make a mental comparison with their arrangements and those commonly fitted on board.

Mr. T. Nordenfeldt, of Parliament Street, London, S.W., has a stand in the North Court, not far from its junction with West Court, entirely devoted to a most superb collection of "Mitis" castings. At the risk of some repetition, having previously referred to this new process in wrought iron or steel, we have pleasure in drawing the attention of our readers to its salient points. It may be incidentally prefaced that the word "Mitis," by which castings made by this new process have been dubbed, is derived from the Latin, and has very appropriately been used in this instance, as the word in the original indicates "tough, flexible, easily moulded, &c." The process is the property of Mr. Nordenfeldt, of gun, ammunition, and submarine navigation renown, and was first manufactured on a large scale at Stockholm, in Sweden, but subsequently similar manufactories have been put into operation at St. Petersburg, in the United States of America, and in the beginning of the present year at Sheffield, Messrs. Seebohm & Dieckstahl, of the Dannemora Steel Works, and Messrs. Hansell & Company, of the Canal Steel Works, both of the last mentioned town, who have secured the sole licenses to manufacture and sell the "Mitis" castings in this country.

At Mr. Nordenfeldt's stand at this exhibition there are numerous examples of most intricate castings, one of which may be described as a brush, and so marvellously has it been produced, that even experienced iron-workers have expressed their incredulity of it being a casting. Partially, without doubt, such results accrue from there only being the best wrought iron or high class crucible steel used in the melting pot, and also the arrangements of the patterns, but the principal secret lies in the addition of certain alloys. For instance, by increasing the percentage of carbon, in the "Mitis" castings, tools and parts of machinery can be made of any degree of hardness, from the softest wrought iron to the hardest tool steel. Among the exhibits of this material we noticed a treble sheaved framework for an anchor-davit block, all cast in one piece, and in the condition it left the mould, requiring only a little dressing off and the boring of the holes to allow of the pin for the the sheaves being fitted. Numerous rollocks for boats are also among the many smaller articles, and judging from what we saw it would almost appear as if in the early future the ship-smith would be no longer an indispensable person to the shipbuilder. There are also a number of warping chocks, but as these are usually considered to be strong enough when of ordinary cast iron they are in a lesser degree interesting, for cleats or rope fasteners of the lighter kind "Mitis" castings may be expected to come into vogue, if the cost permits. The great value of this new process appears, however, to be in being able to produce such articles of a complicated form, at present forged from iron or steel; and more especially when absolute reliability is a *sine qua non*, and we have no doubt that in this respect the domain of castings will increase from year to year. It is well-known that owing to the uncertainty of the soundness of welds in complicated forge-work, heavy scantlings are adopted, than there would be if welded work could be always guaranteed to be equal to the solid section, and it is just in this respect that castings, when reliable (as those of the "Mitis" process have been found to be), have a great advantage, as the material can then be reduced in amount and often better proportioned to its respective work, their great strength and toughness admitting of extreme lightness. These "Mitis" castings can also be quickly produced, no delay being required in delivering them, as annealing is not requisite, and there was a gold medal awarded for them at the Inventions Exhibition, in 1885, and also another at the late Antwerp Exhibition.

Near to the last-mentioned exhibits there is an exceedingly handsome and well-arranged case, containing numerous specimens of the manufactures of Messrs. Seebohm & Dieckstahl, of the Dannemora Steel Works, Sheffield. The exhibits of this firm do not admit of much particularisation, although they are none the less of a high-class quality, and worthy of a careful inspection by all users of cast-steel, or others interested in this quality of material. The case contains bars and fractures of Swedish bar iron, bar steel, cast-steel ingots, and numerous specimens of finished bar steel, illustrating the various stages of manufacture, as well as showing the appearance of the fractures of tool steel, &c., containing varying amounts of carbon. There are also amongst this firm's exhibits, samples of special steels containing chrome, tungsten, &c., tools made from the different descriptions of steel, samples of spiral springs for safety valves, &c., making altogether a very effective show.

Turning aside to the East Court, the nautical visitor will have pleasure in inspecting the exhibits of Messrs. Wilson & Gillie, of North Shields and Sunderland. This firm has an interesting stand, consisting of various instruments, including compasses and binnacles of various patterns and designs, sextants, barometers, &c. Although Messrs. Wilson & Gillie is the only firm exhibiting a complete collection of optician's outfits for sailing and steam vessels, it is of such an interesting nature as to make up for the want of other collections. Prominent amongst the compasses shown is one of Sir William Thompson's patent, complete, with

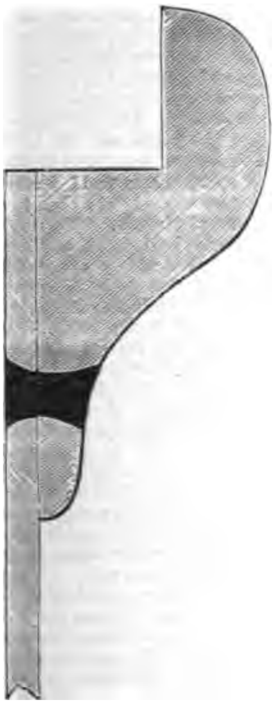


FIG. 1.

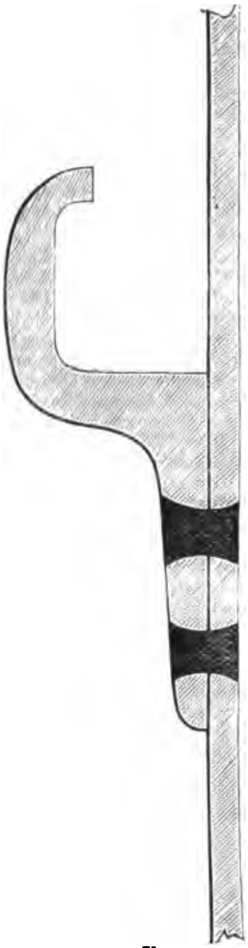


FIG. 2.

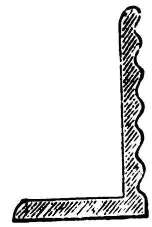


FIG. 3.

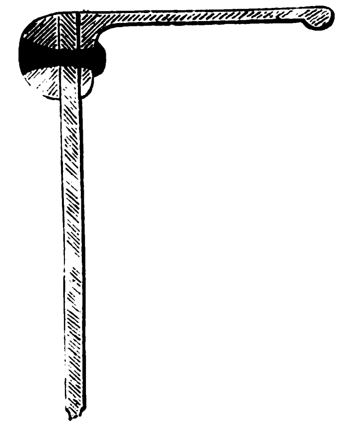


FIG. 4A.

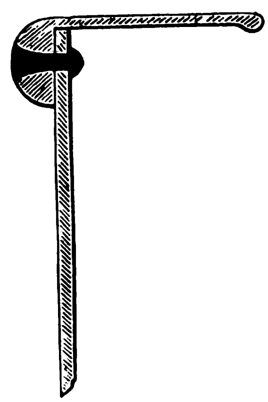


FIG. 4.

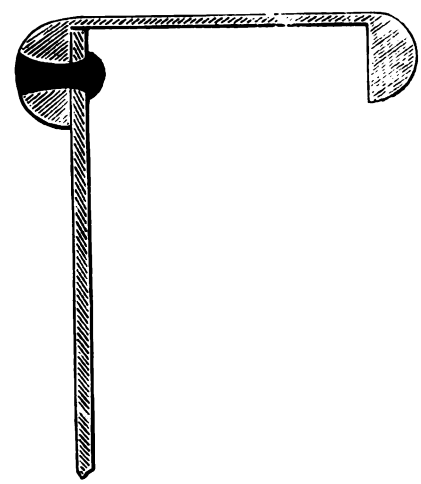


FIG. 5.

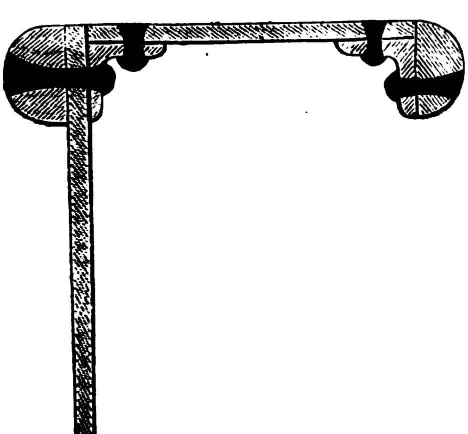


FIG. 5A.

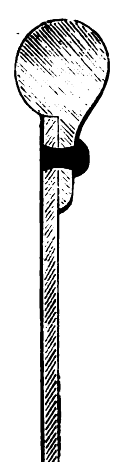


FIG. 6.

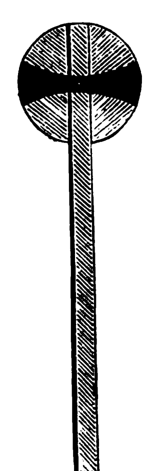


FIG 6A.


FIG. 7.


FIG. 8.

SAMUEL TYZACK & CO. (For Description see page 164).

the same patentee's azimuth fittings—of which a detailed description is not necessary, being now well known. Messrs. Wilson & Gillie also exhibit a very handsome standard compass designed and manufactured by themselves, one of the chief features of it being the arrangement of the compass card. This consists of a very light framework of metal, attached to which are six needles, made of wide, thin steel, set on edge, divided in the centre, with the ends separated about an inch. Compass cards of this description have, in actual practice at sea, been found to give very good results, the cards being remarkably steady and sensitive. These results accord with theory, which requires the weight and directive power, or magnetive moment to be well proportioned and distributed equally over the whole card. This compass has also a new feature in the correctors for the heeling and quadrantal errors. It has been specially examined and reported upon at the Deutsche Seewarte, in Hamburg, and their representative expert affirms that the whole arrangement is excellent, with which, after a careful examination, we cordially endorse. Instead of having an azimuth arrangement fitted to the compass, requiring the removal of the binnacle top every time an observation is taken, there is fitted to the neck of the binnacle one of Gillie's patent course correctors. This course corrector permits of an observation of the sun, or any celestial object being taken with ease and accuracy in almost any weather, giving both the true and magnetic course at the same time, requiring only a glance at the compass underneath to enable the observer to ascertain the compass error, or the deviation, whichever may be desired. A four-point bearing may also be taken with this instrument with much ease and accuracy, and, summing up all its advantages, it is found that this patent course corrector does all that an elaborately fitted and expensive azimuth arrangement does, and, owing to its simplicity, it is almost impossible for it to get out of order. And, what will commend it even more in these depressed days of shipping, it is only about half the cost of the various instruments which, when it is fitted, are no longer necessary. Messrs. Wilson & Gillie also have on their stand another exhibit of very special interest to all who have to face the difficult questions which arise through the iron and steel materials forming the hulls of sea-going vessels, and the carrying of iron cargoes, &c., affecting the action of the mariners' compass. This exhibit consists of a piece of tubing of ductile iron, about three ft. long, movable, on a universal joint. Suspended from it, with their centres in a line parallel to the axis of the tube, are five small compasses, each about 2 in. in diameter. Moving the iron tube into any position or angle, an immediate effect is produced in the various compasses, which show by their action the amount and the direction of the magnetism induced in the iron by the mere change in the position of the iron. This experiment is one which merits the attention of all interested in the question of induced magnetism, and should not be overlooked by any of our readers whose duties require them to guide a ship or steamer on her course. Another useful instrument which this firm has brought out within the last few months is a hydrometer, which, on being immersed in a sample of water from a dock, or river &c., in which the vessel may be loading, shows at a glance by the scale, the number of inches the vessel will rise in actual sea-water. There are also a number of minor novelties on the stand of Messrs. Wilson and Gillie which are worthy of close inspection, but we cannot devote more space to these exhibits as they are of special interest to only a limited circle of our readers.

(To be continued.)

NEW FLOATING DOCK FOR CARDIFF.

ON the morning of June 29th the new floating dock which has been constructed for the Dumfries Dry Dock Shipbuilding and Engineering Company (Limited), Cardiff, by Messrs. Clarke ~~and Standfield~~, at their works, Grays, Essex, was successfully moored on the West Mud, Cardiff. Unusual interest has been felt in the town at what is practically a new departure in the engineering work of the port; and a large number of ladies and gentlemen proceeded in the tug *Scotia* in order to inspect the new dock. The company included Messrs. J. Standfield, contractor, London; James Thompson, engineer, Sunderland; David Morgan, Bute Dock Offices; H. Cloake, jun.; J. W. Stevens, resident engineer; David Thomas, engineer, Cardiff; T. H. Owen, managing director; and W. G. Blow, secretary to the company. The dock reached Cardiff in excellent condition, not having sustained the slightest injury during the voyage; it was launched on June 24th at Gravesend. The dock will remain on the mud until it is able to take up its permanent position at the eastern side of the entrance channel between the low water pier and the channel tip. It will, however, be six weeks or more before all the arrangements can be completed.

The dock is the first of its kind that has been built. Others of a somewhat similar character have been constructed, notably one for Barrow-in-Furness, and it was the great success that attended the floating dock at that port which led to the construction of a dock after the same style, but with many improvements, for Cardiff. In shape it resembles the letter L; the vertical section is 34 ft. 10 in. in height, and the horizontal 65 ft. in length, while it stretches 283 ft. in a direction parallel with the quay. The upright side is attached by 22 booms to 11 vertical girders built into the sea wall, and is also securely attached to a mass of concrete by horizontal and diagonal girders. The result of this is that the dock remains perfectly horizontal, and is as stable as could be desired. The method of docking a vessel is very simple. A valve in the bottom of the dock is opened allowing the water to rush in, and in about 10 minutes it sinks to the bottom, where there is a smooth gridiron to receive it. The vessel is then brought over it, and by expelling a portion of the water, the keel blocks are brought to bear against the keel of the vessel, which then rests on bilge carriages in the shape of the letter V. The blocks are moveable by means of mechanical appliances ashore; and should the vessel be not exactly plumb, they may be raised or lowered until she has been righted. Pumping is then proceeded with until the vessel is lifted high and dry. The dock is capable of lifting out of the water 2,500 tons deadweight in half-an-hour, which represents a carrying capacity of 4,000 tons. It is thus possible to raise a vessel, examine her bottom, and place her back in the water in about three-quarters of an hour, and by this means she can catch the same tide, and save both time and expense. If the vessel be not of unusual size she can be docked in about a quarter of an hour. There are four main gangways connected with the pontoon dock through apertures or passages in the side of the dock. The comfort of the men engaged on the dock is very much increased by the openness of the structure to sunlight and air, and this, moreover, tends to accelerate the process of drying in a very marked degree. Sir Edward Reed, M.P., under whose supervision the work has been completed, has expressed himself in warm terms of admiration on the new departure, especially noting the fact that it is able to dock very short ships as well as long ones, and that in such a manner that the vessels receive proper and uniform support throughout their length, and without any straining. The convenience of such a dock to a port like Cardiff it is difficult to over-estimate. It may be added that the dock is considered to be so excellent in its construction that another on exactly the same pattern has been ordered for the port of Hamburg.

THE INSTITUTION OF MECHANICAL ENGINEERS.

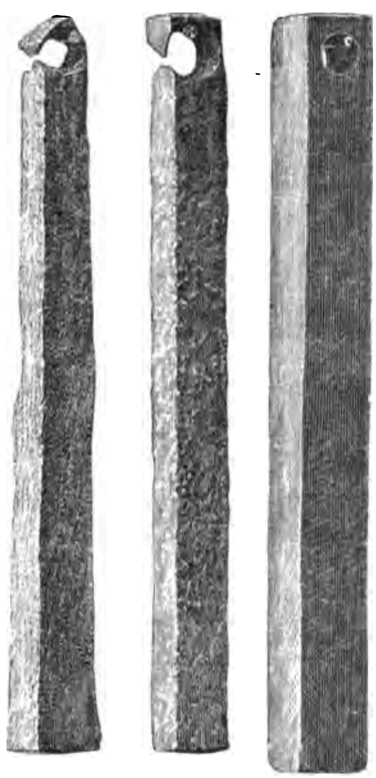
THE summer meeting of the Institution of Mechanical Engineers will this year be held in Edinburgh, commencing on Tuesday, August 2nd, and extending over the three following days.

During this meeting the usual papers will be read and discussed, and a number of works of interest, notably the Forth Bridge Works, the Carron Iron Company's Works, the new Tay Viaduct, the Edinburgh Waterworks, etc., will be visited and inspected. The proceedings will commence on Tuesday with the reception of the president, and the council and members of the Institution, in the University Library Hall, by the most Honourable the Marquis of Tweedale, chairman, and the other members of the local committee, the Right Honourable the Lord Provost, and the magistrates and other dignitaries. The Institution dinner will take place on this day. On Wednesday evening a conversazione, by the invitation of the Right Honourable the Lord Provost and the magistrates, will be given in the Science and Art Museum, when Sir William Thomson will deliver a lecture. Thursday is devoted to an excursion to Dundee and the inspection of the new Tay Viaduct, luncheon being provided by the Dundee reception committee, while for the last day, Friday, several alternative excursions have been arranged, one which will no doubt be appreciated by members living in the south, being to the Newcastle Exhibition. In addition, many works, both in Edinburgh and Dundee, will be thrown open for the inspection of the members during their stay, and with fine weather, which we trust will prevail, no one need have cause to regret journeying to Edinburgh for the summer meeting.

RELATIVE CORROSION OF METALS.

WITH a view to ascertaining the relative corrosion of metals, of a suitable strength for their purpose, in the acidified waters of their mines, the Bonifacius Coal Mining Company, of Westphalia, recently carried out some experiments, the results of which are given below.

At the outset it was found that brass and gun metal were not strong enough, and the trials were therefore limited to iron, steel, and Delta metal. Rolled bars of each of these metals 7·5 in. in length, and having a sectional area of 0·62 square inches, were immersed during a period of six and a half months in the water issuing from the Company's pits at Kray. After removal they were carefully weighed and photographed, the results being shown in the accompanying engravings, the weights before and after trial and the loss per cent. being placed under each figure. From these it will be seen that the difference in loss between the wrought iron and steel bars was but very slight, indeed both having lost, during their six-and-a-half months' immersion, nearly one-half of their original total weight, while the Delta metal bar had lost only one eighty-third of its original weight; in other words, the Delta bar would have worn out nearly forty of the iron or steel bars.



DELTA.

	Wrought Iron. lb.	Steel. lb.	DELTA METAL. lb.
Weight of bars when put in	1·1805	1·2125	1·2787
After six-and-a-half months	0·6393	0·6614	1·2633
Loss	46·3 °/o	45·45 °/o	1·2 °/o

Needless to say after this trial the Company have adopted Delta metal for their underground machinery.

This undeniably proves the superiority of Delta metal in its acid resisting properties, and its other qualities (as regards strength) are too well known to need recapitulation here. To the curious in such matters it may be interesting to note that the Delta metal bar weighed, after the test, very nearly as much as both the other bars together, or more than either of the other bars before the tests, though the weights of all three were then, approximately, the same.

The originals, from which our engravings are taken, can be seen at Mr. Alex Dicks, the patentee and manufacturer of Delta metal, 110, Cannon Street, E.C.

QUADRUPLE-EXPANSION ENGINES.

THE steam yacht *Myrtle*, belonging to Bailie Neill, of Glasgow, which has been supplied with new engines and boilers by Messrs. Rankin & Blackmore, Eagle Foundry, Greenock, and lately had preliminary trials with the most successful results, for, notwithstanding the stormy weather, on running the measured mile at Skelmorlie, an average speed of fully twelve knots was attained, being three knots more than her best speed last summer. The speed of the vessel was then reduced to about eleven knots to represent her average work at sea, and after a run of three hours it was ascertained that the average consumption of best hand-picked Welsh Penrikyber coal was only 1·2 lbs. per I.H.P. per hour. This is the lowest yet recorded with a quadruple-expansion engine of equal power fitted with piston valves, which, taken in conjunction with their wonderfully small amount of initial friction, along with other improvements detailed hereafter, have reduced the total friction to only 8¾ per cent. of the gross I.H.P. The *Myrtle* is 163 ft. long by 20½ ft. beam and 14 ft. moulded depth, her tonnage (Thames yacht measurement) being 318. She has a singularly graceful appearance with her tall slender spars and fine hollow lines. Several notable improvements have been effected on the vessel for the comfort and enjoyment of the passengers, including smoking and hot air rooms, and a large addition to the hurricane deck, which has been continued right over the engine and boiler space, and surrounded by handsome galvanised iron balusters and railings, affording a pleasant promenade. The machinery of the *Myrtle* consists of a novel design of disconnective quadruple-expansion engines, patented by Messrs. J. F. & M. Rankin, which has four cylinders, 12 in., 17 in., 24 in. and 34 in. respectively in diameter, all having a piston stroke of 24 in., working in tandem pairs on two cranks, to which steam is supplied at 180 lbs. pressure by a return tubular boiler 11 ft. 6 in. in diameter by 9 ft. 6 in. long, with two of Fox's patent corrugated furnaces 3 ft. 5 in. internal diameter. The principal feature of these engines lies in the capability of either half being able to propel the vessel in the event of the other half getting out of order, so that repairs may often be effected without much loss of speed, and without external aid, a noteworthy consideration in the avoidance of salvage claims. In order to prevent as much initial friction as possible all four cylinders are fitted with slide valves on the piston principle in lieu of the ordinary flat locomotive type. In addition, the usual four troublesome upper stuffing boxes for the piston and valve rods have been abolished and their places taken by frictionless brasses, and in conjunction therewith the remaining stuffing boxes have been made in halves and bolted to the cylinder covers, enabling the lower cylinders to be examined with the utmost facility without disturbing the upper ones, thus effectually removing a reproach which has long obtained against tandem engines. It may be mentioned in connection with these engines that they only occupy the same space as the old, although indicating double the horse-power; so that they are eminently adapted for cargo steamers or yachts, where economy of space is of primary importance. The results of this trial, confirming as they do the unprecedented economy—so far as the ordinary marine boiler is concerned—of the same makers' pattern six-cylinder engines fitted on board the steam yacht *Rionnag na Mara* last spring, must greatly assist the introduction of quadruple-expansion engines, which are bound to come to the front before long.

MESSRS. HOLZAPFEL & CO.—We have received an official notification from this old-established firm of an alteration in the partnership. This is to the effect that Mr. Frederick Schnitger retires from the business as from June 30th, 1887, the firm being carried on under the same style as hitherto. A local agency will take the place of a branch house at Antwerp; with this exception the business will be carried on as usual at Newcastle, London, Liverpool, and Glasgow, where the anti-corrosive and anti-fouling compositions may be had as before.

SPEED TRIALS OF S.S. "OHIO."

TRIPLE-EXPANSION ENGINES AND HOWDEN'S FORCED DRAUGHT SYSTEM.

THIS steamer of the American line belonging to the International Navigation Company recently left the Clyde for Philadelphia, after completing some important trials of her new machinery in the Channel. Among the party who joined the ship at Greenock for the trial were Mr. Welding, manager of the Inman and International Steam Packet Company, Liverpool; Mr. Doran, superintending engineer of the same company, and Captain Sargent; Mr. Parker, chief engineer surveyor of Lloyd's, London; Mr. Parker and Mr. J. H. Biles, of Messrs. J. & G. Thomson, Clydebank; Mr. Gatow, surveyor of Bureau Veritas, Glasgow; Mr. Mollison, Lloyd's engineer surveyor, Glasgow; Mr. Alexander Morton, Mr. W. R. M. Thomson, Mr. James Weir, Mr. Howden, of contractor's firm, and other gentlemen interested in marine engineering progress.

The *Ohio* is an American-built steamer, 343 ft. by 43 ft. by 34 ft. 6 in., and of 3,325 gross tonnage. She has been entirely refitted with new engines and boilers by Messrs. James Howden & Co., of this city, who have also rearranged the bunker, machinery, and hold spaces, to give the important advantage of increased cargo space obtainable from the use of their improved machinery, which occupies considerably less space than the engines and boilers of same power which it has replaced. The new engines are of the triple-expansion type, and the boilers, of 150 lbs. pressure, are worked on Howden's patent forced draught system, which combines increased power with high economy in fuel. The object of the steamship company in refitting the *Ohio* was to test the capability and economy of this system of forced draught on a sufficient scale to guide them in dealing with high-powered steamships of the largest class.

The recent great advance in the development of high speeds in ocean passenger steamers, especially in the principal Atlantic liners, necessitates in such steamers enormously increased steam power, combined with increased dimensions of the vessels. The large portion of the ship occupied by the numerous boilers and great coal bunkers required by such high-powered steamers fitted on the present system makes the use of an improved system of producing steam which largely reduces the number and weight of the boilers and quantity of coal required for a given power, a matter of the highest importance, for, in addition to the reduced cost of fuel, the space and weight thus saved becomes available for cargo and passengers, and adds directly to the earning power of the ship.

In the refit of the *Ohio* the boilers were designed to work with a very moderate air-pressure, this being sufficient for the power required by the contract. The combined power and economy, however, guaranteed by Messrs Howden & Co. from the use of their system of forced draught, was higher than has hitherto been attempted in any steamship, and sufficient, if attained, to prove the large reduction that could safely be made in the number and size of boilers from the use of this system, and in the quantity of coal required to produce a given power.

The contract for the refit of the *Ohio* required that 2,100 I.H.P. (which was the maximum I.H.P. of the engines removed) be maintained during the trial on a consumption of 1·25 lbs. coal per I.H.P. per hour. The original boilers of the *Ohio*, from which this power was previously produced, were three in number, double ended, 12 ft. 6 in. in diameter by 17 ft. 6 in. in length, having each six furnaces 3 ft. in diameter, or 18 furnaces in all, with an aggregate fire-grate area of 300 square feet. The new boilers fitted with the forced draught are likewise three in number, but single-ended, 13 ft. in diameter by 11 ft. 2 in. in length, having each three furnaces 3 ft. 3 in. diameter, or nine furnaces in all, with an aggregate fire-grate area of 112 square feet. The air for combustion is supplied to the boilers by one of Messrs. W. H. Allen & Co.'s fans, 5 ft. 6 in. in diameter, driven direct by an engine having a cylinder 7 in. diameter by 4 in. stroke. The boilers removed had two stokeholds across the ship, one fore and aft of the boilers, while the new boilers have only one stokehold on the after side of the boilers. The engines removed had cylinders 57 in. and 90 in. diameter by 48 in. stroke, while the new engines had three cylinders, 31 in., 46 in., and 72 in. diameter respectively and 51 in. stroke. The crank shaft of the new engines is carried in four main bearings. The circulating pump for circulating the water through the condenser is one of Drysdale and Co.'s improved "Bon accord" type, to discharge 18,000 gallons per hour.

The valves are on the starting side of the engines, and are worked directly from the piston rods and connecting rods by Morton's patent valve gear, which acted very efficiently during the trial.

During the trial the coals were weighed out under the supervision of the officers of the company, who also took the record of speed and other data.

After running down channel for a considerable period the trial on the coals weighed out began and lasted 4 hours 10 minutes, during which time 10,885 lbs. of Welsh coal were burned, the trial ending with the same revolutions of engines and the same pressure in boilers with which it began.

The mean I H.P. calculated from the mean of seven sets of indicator cards taken during the trial and the mean revolutions per minute found by dividing the total revolutions recorded on the engine counter by the minutes in period of trial was 2,214, making the consumption 1·23 lbs. per I.H.P. per hour, and the power per square foot of fire grate of boilers almost exactly 19 I.H.P. While testing the I.H.P. and consumption of coal the steamer ran up and down between the Cloch and Cumbrae Lights, and also made several runs up and down on the measured mile at Skelmorlie, from which the mean speed of the vessel was found to be 14·12 knots per hour. The remarkably high results obtained were most satisfactory to the representatives of the company, and the party of experts on board congratulated Mr. Howden on the successful fulfilment of the onerous guarantees undertaken. After the official trial other trials of a special character were made before the vessel left for America. The steamer left the Clyde considerably improved in appearance, having been refitted during the period of re-engining with new cabins and deckhouses by Messrs. James & George Thomson, Clydebank.

THE CITY AND GUILDS OF LONDON INSTITUTE FOR THE ADVANCEMENT OF TECHNICAL EDUCATION.

WE recently had the pleasure of attending at an inspection of the Central Institution, Exhibition Road, S.W., and during our visit inspected the several laboratories and workshops, and saw some most creditable specimens of work executed by the students of the various technological classes that have been established in different parts of the kingdom in connection with the Institute. The different laboratories appeared to be complete with all the appliances and apparatus for carrying on the researches to which they were severally set apart, while their dimensions were such as to ensure ample space for every student's requirements.

The workshops proper are fitted with every modern appliance, including an autographic recorder testing machine, and a splendid steam engine specially arranged and fitted for carrying on researches where the power absorbed has to be measured to a nicety.

In the carpenter's shop every care appears to have been taken to provide the students with the most modern and most efficient tools and appliances, and judging from some specimens of their handicraft that were submitted for our inspection they appear to have used these to the best of their ability. Several patterns that we saw in this department would have done credit to any pattern maker.

From the syllabus now before us of the course of lectures to be delivered during the summer term, we can only say that it appears to us as though every care has been taken to ensure such lectures being delivered as will most enhance the value of the Institute from a technological point of view.

In nearly every case the fees and hours of attendance have been arranged so as to bring them within the reach of the artizan, and we wish the Institute every success in their laudable endeavour to impart a thorough and sound technical education.

THE Admiralty have decided to build two very fine sheathed cruisers at a cost of nearly £500,000. The order is expected to be placed in the North of England, and three leading shipbuilding firms are in correspondence on the subject with the Admiralty.

THE TORPEDO BOAT ACCIDENTS.

THE following notes on this subject have been furnished by Mr. Niel McDougall, late Admiralty Inspecting Officer, and now Chief Engineer of the Boiler Insurance and Steam Power Company. Mr. McDougall was present at the inquest, and made a careful examination of the injured boilers.

(1) It was evident from the first introduction of these boats that imminent risk of a part, or of the whole of the fire-box crown becoming bare of water, must always be faced while running in a rough sea, or even in any weather at high speed. The boiler of the *Lightning*, which, together with a number of the boilers of the first torpedo-boats built for the Admiralty, were constructed under my supervision, was stayed in the same way as Nos. 47 and 57 boats. The general design of the *Lightning's* boiler is also similar to these, with the important exceptions, however, that the *Lightning's* boiler had brass tubes, was fitted with fusible plugs in the fire-box crown, and being a much smaller boiler, has a correspondingly smaller fire-box. No serious accident has ever happened to the *Lightning's* boiler, although she certainly must have been subjected to a considerable amount of rough usage during her time.

(2) As the boilers are specially subject to overheating, the importance of providing in the design against accidents from this source is evident, and I think the best way to arrive at a just conclusion as to the relative advantages in this respect of various modes of staying is by observing the behaviour of different stays when accidents take place. Among the 22,000 boilers of all types in use on land and at sea under the supervision of the company I represent, two accidents per week, coming under the head of "collapse of furnace" occur on an average. These accidents are almost invariably due to overheating of the furnaces from shortness of water, or from greasy or other deposit being allowed to accumulate on the furnace plates. No accident has occurred from the giving way of the crown stays of any boiler fitted with stays attached to the roof, and riveted over like those used by Messrs. Thorneycroft, but we had some time ago a narrow escape of a bad explosion in the case of a large boiler of the locomotive type with riveted crown stays. It was the stays to the front of the fire-box which, however, gave way in this case. The crown stays were undisturbed, although their riveting could scarcely have been as sound a job as in the torpedo boat boilers. The centre stays were 1 ft. 8 in. long, and as the upper ends were screwed into sockets attached by pin joints to a tee-iron riveted to the fire-box shell, there was no possibility of solid holding up against the riveting. The threads of both the top and bottom ends therefore no doubt suffered in riveting the lower ends.

(3) The threads of the stays drawn through the crown plate of No. 47 boat boiler, which I examined very carefully, had evidently not suffered in the riveting. They were perfect, with the exception of being bevelled from having been drawn hot through the tapped stay-hole. The accidents to the boilers of both Nos. 47 and 57 boats show clearly, I think, that there is small chance of a disastrous exploson from shortness of water with the rivetted crown stays. In No. 47 boat, the water level must have been some 15 in. or 18 in. below the fire-box crown before the fire ceased to act on the plates, and the result, after all, was purely local. The boat had a list to starboard, and the stays were drawn through the crown plate on the port side of the boiler, giving comparatively gradual vent to the steam, and nothing in the nature of an explosion occurred. Had the flaps of the ashpit been free to act, no doubt the lives of the three men would have been saved.

(4) The difference in the holding power of riveted and nutted stays when spaced widely apart was investigated during the inquiry into the *Thunderer* explosion. It was shown in the case there under consideration that, with the same spacing, the nutted stay was decidedly the superior with the plates and stays cold. Where an accident occurs, however, from overheating, the nutted stay either (*a*) draws through the plate and nut, or (*b*) draws the nut through the plate, or, finally (*c*), the shank of the stay may part either in the hole or on the water side of the crown plate. It is in the last case (*c*) where the danger of the nutted or solid headed stay lies. If the stay is screwed into the crown plate, the thread will prevent the bit of stay attached to the plate from being blown into the fire, and the hole will remain plugged. Stay after stay may part in this way without giving vent to the steam, and a disastrous explosion may result from rupture of the unsupported plate. This action cannot, of course, take place if the stay is not screwed into the plate.

(5) A recent case we had illustrates this. A boiler of the locomotive type, stayed with girder stays on the fire-box crown, was allowed to get short of water. The bolts through the girder and crown plate were nutted on the inside of the fire-box, but were not screwed into the plate. One bolt parted in the shank, and the bolt end, with the nut, dropped into the fire, acting like a fusible plug. Neither the plate nor any of the other stays were ruptured, no one was hurt, and the accident cost us only £35 for the repair of the fire-box. Had the stays been screwed into the plate, and furnished with nuts or solid heads inside the fire-box, it is not likely we should have got off so easily. Putting it from an insurance point of view, I should be inclined to take a higher risk for the same premium on a boiler with riveted crown stays than I should on one fitted with nutted or solid headed stays, if these latter were screwed into the plate, calculating that there would be the least chance of our having to pay the full amount insured with the riveted stay. As may be gathered from the particulars given above, however, there are other modes of attachment of stays in use which would appear to be preferable to either of the systems under consideration.

(6) I think the Admiralty have been wise in substituting iron for brass tubes, but I doubt the policy of dispensing with fusible plugs, which annually prevent numbers of boilers from being seriously injured through shortness of water. The larger size of the fire-boxes now used involves greater risk, and although the fitting of two small boilers in lieu of one large one introduces additional weight, and would require more space, their use would be attended with greater safety in heavy weather, and would possess other evident advantages for a fighting vessel of this kind.

(7) The result of the inquest, from an engineering point of view, is, of course, extremely disappointing. No serious attempt was made to show how the boiler became so empty of water. No evidence whatever was given in support of the theory advanced by the Admiralty engineering representative—who was bound in good faith to tell the court all he knew—that the loss of water from the boiler was due to heavy leakage round the tubes. The tube-plates showed no sign of such leakage, and it is past belief that so large a quantity of water could have been poured into the fire without someone becoming aware of what was going on. Among other disagreeable experiences I had in the earlier days of these boats, I was on deck when the end of a brass boiler tube broke off, and I helped the stoker up before he fully realized that anything serious had occurred. The dense volumes of steam, however, coming out of the funnel told us at once on deck that heavy leakage of some kind had taken place. Fortunately for the stoker in this case the ashpit arrangement—Yarrow's—for guarding against the effects of mishaps of this kind answered admirably.

(8) Had the engine and boiler in No. 47 boat, with all the fittings implicated, been subjected to a careful and exhaustive examination immediately after the accident, and before anything was disturbed, the cause of the loss of water might have been discovered, and there would then at least have been some compensation in the experience thus gained for the lamentable loss of life which has occurred. Looking at the work for which a torpedo boat is intended, the use of fusible plugs, or of stays which will act in a similar manner, are, after all, minor matters. The blowing out of a plug, or the giving way of a stay, or tube, which would prevent a violent explosion of the boiler, would certainly cripple the vessel, and probably place her quite as much at the mercy of an enemy as if an explosion occurred. The questions of real importance requiring the grave attention of the Admiralty are with regard (1) to the employment of men of sufficient training and intelligence in the working of machinery essentially delicate, with whatever skill it may be designed; and (2) to the simplification to the greatest possible extent of engines and boilers which have to be used in the excitement of an action. With regard to the latter point, some of the arrangements—notably that provided for shutting off the water-gauge cocks from the engine-room in the event of a glass breaking, although introduced with the best possible intentions, are, in my judgment, directly conducive to accident. It is more than possible that the water was locked in one of the gauges in No. 47 boat by this very arrangement. Again, the Admiralty instruction to use the blow-off, so as to run with the smallest possible quantity of water, is liable to lead to accident from failure to close the cock properly after blowing out. How much of the large quantity of water which disappeared found its way into the sea in this way, or through other complicated connections insisted upon by the Admiralty, as I understand, will never now be discovered. One thing, I think, is at all events certain, that had much of it escaped either into the fire or elsewhere in board, it would have made its presence felt in some way.

THE AMERICAN EXHIBITION, EARL'S COURT.

It is eminently characteristic of the go-ahead American people that they should elect to hold an exhibition devoted exclusively to their own arts, inventions, manufactures, products, and resources upon the soil of another country, and that country over 3,000 miles away from them; and though the exhibition, considered purely as an exhibition, is not so complete as we should have wished to see it, yet we heartily wish the promoters of it every success in their bold venture.

As a place of amusement the present exhibition vies creditably with its more ostentatious predecessors of South Kensington, and it might truly be said that the 23 acres of ground occupied have, from a sightseer's point of view, been utilized to the very best advantage, so diverse and varied are the attractions.

Briefly, we may state that the main building faces the Lillie Road, and is near to, and west of, the West Brompton Station. The south elevation, containing the executive offices, is of light coloured brick and stucco, and with its 210 ft. frontage is yet pleasing and graceful in outline. Running north from this as an entrance is the main court, 120 ft. wide, and 1,140 ft. long. The framework of this court is constructed throughout of railway rails covered with corrugated iron and glass. This gives a very light and airy appearance, while having the advantage of being practically fire-proof. This is laid out in streets and avenues running at right angles to each other, much in the way that American cities are commonly built. In this court is placed all the machinery in motion, and here are to be seen numerous processes of manufacture in full swing. The art gallery, 160 ft. by 80 ft., is on the west of the main court, and contains the largest collection of exclusively American paintings that has ever been exhibited in Europe.

In the grounds the great attraction is "Buffalo Bill's" unique display. In this he is aided by some two hundred Indians, cowboys, scouts, etc., and their feats of strength, shooting, horsemanship, etc., are undoubtedly one, if not the chief, of the attractions of the exhibition. In the grounds are also to be found the usual music pavilions and refreshment places, while models of the switchback railways, roller tobogganing, etc., appear to afford amusement to many of the more venturesome visitors. Taken altogether the "Yankeries" is an exhibition decidedly worth the seeing.

Among the exhibitors we notice several familiar names, and it is our intention to refer to some of these at length in the present and future issues.

Messrs. Boult Bros. & Co., of 38a, King William Street, E.C., and elsewhere, have a stand on which they show samples of their well known "Valvoline" oils (an absolutely acidless lubricant, in the preparation of which every modern improvement and care is used to ensure its being *the best*). This firm also exhibit some remarkable specimens of scale that have been removed from boilers after the use of their "Eucalyptus" solution (notice of which appeared in a recent issue). Some of these were entirely beyond the reach of hammer and chisel, and after seeing them one is led to wonder not at a boiler steaming badly, but that it should make steam at all under such conditions. We also noticed on this stand the sight feed lubricator of which this firm are making a speciality, and the very efficient needle lubricators, noticed in our issue of November, 1886. This sight feed lubricator is a simple and well made instrument, and though it is not embellished with the usual array of cocks, valves, syphons, etc., it has proved itself capable of doing its work thoroughly and reliably. It speaks well for Messrs. Boult's lubricators that the Engineering Committee of this Exhibition should, after keen competition, have fitted them to the engine, and also the needle type, to the whole line of shafting.

The Blackman Air Propeller Co., of 63, Fore Street, E.C., exhibits on behalf of the Exhaust Ventilator Co., of Chicago, two of their 48 in. propellers in motion. These are fixed in a temporary erection specially arranged for showing the capability of the propeller when exhausting from, blowing into, or circulating air in any space or building. The two propellers are so arranged as to give two parallel columns of air, but moving in opposite directions. They also exhibit a stack of seven propellers showing the usual stock sizes, namely 14 in., 18 in., 24 in., 36 in., 48 in., and 60 in. diameter.

The Morse Twist Drill and Machine Co., whose London agents are Messrs. Buck & Hickman, of Whitechapel Road, E., have a very fine exhibit of their splendid products, including an assortment of the well-known patent straight lip increase twist drill; straightway drills; solid and shell reamers; milling cutters; taps and dies; screw plates; drill chucks and grinders, &c.

Messrs. G. & H. Barnett, of 21 to 43, Richmond Street, Philadelphia, exhibit some very fine specimens of machine-cut files. This firm also exhibit in a separate case a monstrous file, said to be the largest in the world, and weighing 240 lbs. Judging from its colour it appears to be as well and evenly tempered as those weighing only a few grains.

The Metallic Engine-Packing Co., Limited, of 8, Union Court, Old Broad Street, E.C., are the exhibitors of a very serviceable looking metallic packing, known as the "Jerome" patent metallic packing. This has been fitted to 3,000 locomotives, and amongst many others is used by Sir G. Armstrong & Co., Hawthorn, Leslie & Co., R. Stephenson & Co., John Elder & Co., &c. We hope to further describe and illustrate this packing in a future issue.

Mr. J. B. Stoner, of 115, Broadway, New York, exhibits two large floating models, one of his improved lighthouse, or telegraph and lifeboat station, and the other of his improved float, intended for marine hospitals, coaling stations, floating batteries, &c. The plan of construction is such that there can be no circular or lateral motion. This is secured by using four mooring chains, each passing through slotted irons at the outer edge of the float, and connected in the centre to a weight of from 25 to 100 tons according to the size of the float. As each chain passes over a sheeve the weight rises or falls with the tide or action of the waves, and the mooring chains are always kept taut; hence there can be no lateral motion unless sufficient pressure is brought upon one chain to lift the whole weight, which could never occur as there are no straight lines for the waves to strike, in fact the whole superstructure is built upon a large number of floats which offer practically no resistance to the water.

The United States Metallic Packing Co., of 267, South Fourth Street, Philadelphia, exhibit their self-adjusting packing for piston rods, valve spindles, pump plungers, &c. A model of the piston rod of the s.s. *Somerset* is shown fitted with the self-adjusting packing. This vessel ran 86 voyages between New York and Bristol (England), and the packing even after this protracted trial did not require renewing.

Messrs. Guion & Co. of Liverpool, exhibit a splendid model of the R.M.S. *Alaska*, which has been previously described in our columns, and is the reduced *fac simile* of too well known a vessel to need any further reference here.

Messrs. Henderson Bros., of Glasgow, also exhibit two splendid full models, one of the s.s. *City of Rome*, and the other of the s.s. *Belgravia*, both well known Anchor Liners.

The New York Boat Oar Co., whose agents in England are Messrs. J. Gardner & Sons, of Bootle, and West India Docks, E., are the exhibitors of various forms of oars, sculls, sweeps, handspikes, etc., and also of two magnificent panels, showing the various descriptions of American fancy woods. Pressure on our space compels us to hold over several other notices; we should not, however, fail to notice here the very fine engine used for driving the machinery in motion. This was built by Mr. Jerome Wheelock, of Worcester, Mass., and is fitted with his well-known automatic cut-off valve gear. The cylinder has a diameter of 23 in., the stroke being 48 in., and the diameter of the fly wheel, which is also used as the driving wheel, is 16 ft.

The whole of the electric light arrangements throughout the Exhibition are in the hands of Messrs. Laing, Wharton & Down, of 8 and 9, Holborn Viaduct, who are using the Thomson-Houston system exclusively.

Messrs. Tuck & Co.'s New Factory at Cardiff.—We announced in a recent issue that Messrs. Tuck & Co. were about to erect a factory at Cardiff wherein to carry on the manufacture of their well-known "triple" packing. The inaugural ceremony took place on July 20th, when the complicated machinery for the manufacture of the "triple" packing was first put in motion. Messrs. Tuck have chosen for the location of their new works a spot situated near the Junction Dry Dock, and thus, so far as location is concerned, they are admirably situated, while the machinery of the latest type is capable of turning out £1,200 worth of packing a week, an output which can be greatly increased within the present building as the merits of the material become known. Although the event was of a private nature, many gentlemen interested in the trade of the port were present to witness the inauguration of a new industry, and one which we trust will meet with every success. A notice of this packing appeared in our issue of January, 1867, and we may mention that it is now obtainable at most of the principal ports.

SUMMER SESSION OF THE INSTITUTION OF NAVAL ARCHITECTS.

WHILE we are going to press the summer session of the Institution of Naval Architects is being held under the presidency of the Right Honourable the Earl of Ravensworth, at Newcastle-on-Tyne.

Commencing on Tuesday, July 26th, and terminating on Friday the 29th, it would have been thought that ample time had been provided for all the purposes of the session, but the excellent programme put forth for the meeting, coupled with the many places of interest in the neighbourhood kindly thrown open for the inspection of the members, will leave no time to spare.

After the official reception on Tuesday by the president and council of the North-East Coast Institution of Engineers and Shipbuilders, the Mayor of Newcastle, and the general reception committee, the presidental address was delivered. Following this two important papers were read, and then the members adjourned to partake of luncheon at Elswick, and to inspect the works and shipyard of Sir W. G. Armstrong, Mitchell and Co., on their invitation. Wednesday will be a busy day, as the members journey from Newcastle at 9·15 to Sunderland, where they will be officially received by the mayor, shipbuilders, and engineers of that port. Here, after the reading and discussion of two papers, luncheon will be provided by the general committee, this being followed by a drive to the Chain, Cable, and Anchor Testing Works of the River Wear Commissioners, where various tests will be seen in operation; from here the members will betake themselves to the pier works. A long and pleasant day will be wound up by a conversazione and reception by the Mayor of Newcastle, Sir Benjamin C. Browne, and Lady Browne, at the exhibition. On Thursday the election of candidates takes place, and after the reading of a paper and luncheon at the Town Hall the members will split up, some going to Jarrow to inspect Messrs. Palmer's Shipbuilding and Iron Company's Works, while others go to Low Walker to inspect the shipyard of Sir W. G. Armstrong, Mitchell and Co., and the shipyard and engine works of Messrs. Wigham, Richardson & Co. After wending their several ways back to Newcastle, the dinner of the Institution will be held at the exhibition, at 7 p.m., so closing another long day. Friday will see the members at Consett, where the iron and steel works of the Consett Iron Company are to be inspected, and luncheon partaken of at the invitation of the company.

This completes the arrangements, and so will end the summer session for 1887.

THE P. & O. STEAMER "VICTORIA."

THE recent arrival of the Peninsular and Oriental Company's new steamer *Victoria* at Southampton from the Clyde is a noteworthy event in the company's history. This is the company's jubilee steamer, which has been named after Her Majesty. Yet the addition of the *Victoria* to the company's fleet commemorates not only the completion of the fifty years during which the Queen has reigned over us, but also the completion of the fifty years during which the Peninsular and Oriental Company has been in existence. Were it possible to place one of the company's first vessels alongside of the last, the contrast would be alike striking and instructive, and would mark the extraordinary progress made in the construction of steamships far better than volumes of facts and figures. In dimensions the *Victoria* is not behind some of the leviathans which traverse the ocean. Her length is 465 ft. 9 in.; breadth, moulded, 52 ft.; and her depth 37 ft., with a gross tonnage of 6,267 tons. It is estimated that she can be driven 15 knots, with an expenditure of 100 tons of coal in the 24 hours, this remarkable economy being due to her triple-expansion engines. These have cylinders 40, 60, and 100 inches in diameter respectively, and a stroke in each case of 72 in., and develop about 7,000 I.H.P. The boilers, six in number, are double-ended and constructed throughout of steel. Each has six furnaces and has been tested to 300 lbs. per square inch. In addition, a three-furnaced auxiliary boiler is carried for general purposes. We should here mention that all these seven boilers, as well as all steam pipes, have been covered with Messrs. A. Haacke & Co.'s well-known fossil meal composition, a mixture which we understand is giving every satisfaction wherever applied. Her carrying capacity for cargo is very large, while she has ample and comfortable accommodation for 154 first-class, 156 second-class, and 430 third-class passengers. The quick manipulation of cargo is ensured by a number of hydraulic cranes and hoists, fitted by Sir W. G. Armstrong, Mitchell and Co. The *Victoria* has been placed on the Admiralty list, so that, if occasion required, she could be utilized as a fast cruiser or transport. In the latter event she would carry nearly 4,000 troops. Her builders are Messrs. Caird & Co., of Greenock, who in the last fifteen years have built for the Peninsular and Oriental Company some of the finest ships afloat, their aggregate dimensions amounting to 100,000 tons.

After an official trial trip, when the *Victoria* fulfilled even more than had been expected of her as regards speed, a cruise down the Clyde was made before she was formally transferred from the builders to the company. On the return voyage an entertainment was given in the saloon by Messrs. Caird & Co., at which upwards of 100 persons were present. Mr. Sutherland, M.P., the chairman of the company, in returning thanks for the toast of success to the new steamer, gave a graphic sketch of the company's career, and showed how many of the triumphs achieved in recent days were due to a persistent determination to keep abreast of the times. He impressed upon his audience the great difference between the conditions under which the subsidized German and French lines and the Peninsular and Oriental Company carry on their work. While the foreign companies have great latitude in executing their engagements, the Peninsular and Oriental Company have to fulfil their contract to the letter, having to observe as great regularity in carrying the mails between this country and India, China, and Australia as is observed by the railway companies carrying them between London and Greenock. Thus, as he remarked, it happens that when the mail from the East is delivered in London, the steamers of the Peninsular and Oriental Company had started simultaneously from Japan, Sydney, Calcutta, and Bombay, had converged first at Suez and next at Brindisi, the total mileage covered on reaching Brindisi being 20,000, and yet few cases had occurred for many years of the mails being delivered an hour after the appointed time.

At noon, on Saturday, July 16th, the *Victoria* started from Greenock for Southampton. Many of the passengers were connected with the company, others represented the builders, and others were present to celebrate in this form the Jubilee of the Queen and the company. Chief among those representing the company were Mr. Sutherland, the chairman; the builders were represented by Mr. Caird and one of his sons; while of the general public the more noteworthy were Sir George Elliot, M.P., Mr. Yates, Captain Methuen, Mr. J. C. Parkinson, Sir Henry Edwards, Mr. Graham, Mr. Macdonald, Sir John Monckton, Mr. Maitland, Mr. Hendry, Mr. Letchworth, and Mr. Boughton, A.R.A. The weather was most favourable, and the view of the banks of the Clyde below Greenock was seen at its best. Ailsa Crag appeared to the greatest advantage as the huge vessel passed it on proceeding to the Irish Channel. Down that channel the vessel moved with a smoothness of motion which delighted all who were concerned in her construction. At the Land's End a fresh breeze was blowing, which served to demonstrate the steadiness of the ship, and from start to finish nothing occurred to show that there was a single miscalculation or flaw in the machinery. It is rare, indeed, that some defect does not show itself on the first run of a large ocean steamer; in the case of the *Victoria* the remark made by Mr. Caird when she left her moorings was fully justified by the result—"A finer steamship has never left the Clyde." A stoppage was made for 12 hours at Torbay. The general result of the run showed, however, that an average speed of upwards 15 knots was attained without driving the engines to their full capacity. Not less striking than the behaviour of the vessel is the rapidity with which she has been constructed. The contract provided for her delivery next October, yet she has been only nine months on the stocks. A sister ship, the *Britannia*, will soon be launched, and thus the Peninsular and Oriental Company begin the second half century of their existence by adding to their fleet two magnificent steamers, which at no distant day will have two others of equal magnitude as consorts. But a few years ago the *Rome* and *Carthage* were the two finest vessels which the company possessed; both will be eclipsed by the *Victoria* and *Britannia*. Not in size only, but in general arrangement also, the *Victoria* is a model vessel. The accommodation for second-class passengers is quite as good as that which was offered to first-class passengers in all steamers a few years ago and in many now. The third-class are far better provided for than in the principal Atlantic steamers. Special attention has been paid to ventilation, the saloons and berths

of every class being kept sweet and pleasant by continuous currents of fresh air. All the passages are planned so as to allow of the ingress of plenty of light as well as air by day, while there, as well as throughout the ship, incandescent electric lights render every spot and corner bright and cheery by night. In connection with the lighting and ventilation of the vessel we should mention that Messrs. J. Stone & Co., of Deptford, have fitted the vessel throughout (as they have done all other P. & O. vessels) with their well-known specialities, these embracing their patent "pivoted" side scuttle, and their patent "simultaneous fastening" side scuttle. This firm have also fitted on board the *Victoria*, and other vessels of the line, their "Navy" pump and fire engine, patent "floating palace," double and single valve W.C.'s, and their Admiralty pattern portable pumps.

INDUSTRIAL NOTES.

THE CLYDE AND EAST AND WEST OF SCOTLAND.

No particular signs of improvement have recently taken place in connection with Clyde shipbuilding and marine engineering, and the intervention of the customary holiday period from the 14th to the 25th July has made the prevailing dullness and inactivity more pronounced. Some of the firms closed their works for a much longer period than usual at the "Fair holidays," while others, to expedite work on one or two vessels wanted in haste, curtailed the number of holidays. The London and Glasgow Company closed on the 14th and do not open again till the 1st August, they having only one vessel on the stocks and being built at the builder's own risk. Messrs. Barclay, Curle and Co. closed their works on the 15th and reopened again on the 19th in order to hasten the completion of a vessel being built for Provost Shankland, of Greenock. In Messrs. Alex. Stephen and Sons' yard—which is about the only establishment excepted from the prevalent depression, having at present four large vessels on the stocks and several just launched—the operatives' holidays were limited to two days, viz., 15th and 16th July, in order to expedite matters on several contracts which are required to be completed at the earliest possible date. Very few of the firms on the river have more than two vessels on the stocks, which, as will be gathered from what has already been said, several of the yards are only kept open by builders laying down vessels "on spec." There has not, however, been an absolute want of new contracts during the month, but with the exception of an important Government order received by the Fairfield Shipbuilding and Engineering Company, these are all of a small character. The Ailsa Shipbuilding Company, of Troon, at the beginning of the month booked an order for a steel screw steamer of over 1,200 tons; Messrs. M'Arthur & Co., of Paisley, received an order from a firm in China to build a stern wheel steamer, 170 ft. long, for service in the Yank Sea, China, which will be constructed, then taken to pieces, and shipped to its destination. The engines for this craft will be supplied by Messrs. Bow and McLachlan, Paisley, and they will be on the quadruple-expansion type. This firm has also received a further order from Messrs. Cook & Son for a new set of triple-expansion engines for one of their tourist steamers plying on the Nile. Messrs. Scott & Co., of Greenock, have contracted to build and engine a screw steamer of about 600 tons for trading in the East. The contract referred to as having been secured by the Fairfield Company is for the construction of the hulls of two wood-sheathed protected cruisers for H.M. Government, which are to be named the *Marathon* and the *Magician*. The vessels are to be 265 ft. long, 42 ft. beam, and 19 ft. draught, the tonnage of each being 2,950 tons. They are similar to the 20 knot cruisers asked for by Lord Charles Beresford, but they will have wood-sheathed bottoms, protective deck, and horizontal engines. Their armament will be considerable. The contract for the engines, it is understood, has gone to Messrs. Hawthorn, Leslie & Co., on the Tyne. The horse-power to be developed by these engines is about 10,000, and the speed to be attained by the vessels 20 knots. The Tyne firm just named, it may be added, has just secured the contract for a China steamer of medium size, for which several Clyde firms tendered.

The Royal National Lifeboat Institution has been replacing many of the lifeboats stationed round the coasts of Scotland with new boats, embodying the latest and most approved properties of stability and self-righting power, and the latest is one presented to Stonehaven. The boat is 34 ft. long and 8 ft. beam, and is fitted with water ballast tanks.

For the Clyde Bridge Steel Works, now in course of erection three or four miles to the east of Glasgow, and to which reference was made in last issue's "Notes," Messrs. Penman & Co., Glasgow, have been instructed to build six double-flued Lancashire steam boilers, 28 ft. long by 7 ft. 6 in. diameter. The boilers are to embody all the most recent improvements, and are to work at a pressure of 100 lbs. per square inch. The contracts for other necessary machinery and plant are being prepared, and will be given out shortly.

The Executive Committee of the forthcoming Glasgow International Exhibition have accepted the offer of Messrs. William Shaw & Son, Glasgow, for the erection of the main buildings of the exhibition. Altogether 17 tenders were received, that by Messrs. Shaw & Son being the lowest. The area to be covered by the buildings will be fully 10¼ acres, or 3 acres more in extent than occupied by the Edinburgh Exhibition of last year. The cost of erection will be within the architect's original estimate, notwithstanding that the plans have been considerably departed from. It is proposed by the Exhibition Committee to deepen the River Kelvin for a length of about 700 yards fronting the exhibition to an average depth of 6 ft., for the purpose of showing steam and other small craft at work in their native element. For this work the committee have just accepted the offer of Messrs. J. and A. Faill, contractors, whose tender was the lowest of several sent in.

Preparations are already afoot in the model making departments of Clyde shipyards for the representation, by highly finished models, of the various kinds of steam and sailing vessels for which Clyde firms are noted. Messrs. A. & J. Inglis, of Pointhouse, will be represented by models of four different classes of vessels. These are the *Ho-Nam*, a China river steamer, somewhat of the American pattern built about four years ago, and one of quite a fleet of similar special vessels which Messrs. Inglis have built for China; the swift screw steamers *Forth* and *Thames*, built for the Carron Company's new service between Grangemouth and London; the yacht *Cressida*, built for, and owned by, Mr. John Inglis, jun., and the 5,000 tons screw steamer now in course of construction for the British India Steam Navigation Company. The Fairfield Shipbuilding Company will have on view, besides a variety of ships' models, a number of neatly executed models of engines, illustrative of the principal features in modern marine engineering, as well as photographs of vessels of various description. Full rigged models of various types of iron sailing ships will be shown by Messrs. Charles Connell & Co., of Scotstown, while the firm of Messrs. Barclay, Curle & Company purpose showing models of steamers, sailing ships, and river boats of all types, arranged to illustrate in chronological order the progress effected in recent years in the science of naval architecture and the development of practical shipbuilding. A somewhat similar collection of models will also be shown by Messrs. Alex. Stephen and Sons, of Linthouse, thoroughly representative of the various types of vessels built by the firm during the period of its existence. Many of the other shipbuilding firms have already put exhibits in hand, and it is anticipated the display of ships' models made will rival the Liverpool Exhibition in this respect, while the latter will be far outrivalled in the matter of marine engineering exhibits.

An action, of considerable interest to shipbuilders and marine engineers, has been instituted in the Court of Session at the instance of the Aberystwith and Aberdovey Steam Packet Company, Limited, against the Grangemouth Dockyard Company and others, in which pursuers conclude for payment of £1,500. By memorandum of agreement dated 28th September, 1885, defenders agreed to build for pursuers an iron screw steamer at the contract price of £3,950, in pursuance of which a steamer now known as the *Countess of Lisbourne* was built and delivered. On delivery, however, pursuers aver that it was found the vessel was neither of the carrying capacity nor of the dimensions agreed upon. Instead of being able to carry 210 tons, including bunkers, at a mean draught of 8 ft. 6 in. as per agreement, she was only able to carry 163 tons 17 cwt., and at the same time leave a freeboard of 8½in. as required by the Board of Trade. Further the vessel was 2in. less in depth than was contracted for, and in consequence the freeboard was proportionately diminished. The vessel, say pursuers, has thus been rendered wholly unsuited for the purpose intended, and is of greatly less value than if she had been constructed in conformity with the contract. The defenders aver that the vessel was in every respect in conform to contract, and that she was capable of carrying 210 tons, including the extra weight put into her on the pursuers orders

at a mean draught of 8 ft. 6 in. There was no stipulation in the contract that there should be any specified freeboard at that draught. With the view of avoiding any dispute the defenders say that they offered to alter the steamer so as to make her carry the necessary deadweight assuming her to be deficient, or alternately to pay the pursuers a sum equal to the cost of altering her, at the same time offering to forego their own claim of £152 11s. 2d. for extras. It is also averred that as the result of a survey of the vessel made on the 13th December last at a cost of £60, it was found that, taking into account the extra weight added in consequence of the alterations ordered by the pursuers, she was capable of carrying the deadweight specified in the contract. While denying liability for any damages, the defenders offer, with the view of settling matters amicably, to deal with the pursuers' claims on the footing of the offers referred to. This somewhat remarkable disagreement and direct conflict of statement on matters which should be capable of easy settlement by the evidence of third parties after an inspection and measurement of the vessel herself, proves very forcibly that contracts for ships should not be entered into except on the basis of a full and explicit specification, backed up by intelligent supervision in the actual work of construction.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—At a recent meeting of the Tyne Commissioners it was stated that the number of laid up steamers in the port, which in July, 1886, amounted to 107, had been reduced to less than a dozen in July, 1887. This is a very significant fact, and hopes of a sanguine nature may reasonably be founded on it. It has always been felt that the clearing of all surplus tonnage from our docks and rivers was a necessary preliminary to a revival in shipbuilding, and as the clearance has now been very nearly effected, it is not unreasonable to hope that the other long wished for contingency may not be very remote. The latest report issued by the Boilermakers' and Iron Shipbuilders' Society states that on the Tyne the shipbuilding trade is already improving, several new orders having been received, and a good many repair and alteration contracts secured. Among the recipients of orders for new vessels Messrs. Wood & Skinner, of the Bill Quay Yard, may be first referred to, as they are a comparatively young firm, and have shown exceptional enterprise in competing for work since the opening of their establishment. This firm secured an order early in the month for two steel steamers of average size. The construction of these vessels will be commenced very shortly, and in the meantime the firm are proceeding actively with the building of a vessel which is at present the only occupant of their stocks. Messrs. Dobson & Co., Low Walker, have also obtained an order for two vessels, but they are of small dimensions and their construction will not provide employment for many men. Messrs. Armstrong, Mitchell & Co., have put a large vessel off the stocks during the month, and commenced the building of three small river steamers. It is understood that the firm have other orders, and no fears are entertained of any serious falling off from the present state of briskness during the current year. Messrs. W. Richardson & Co. launched a vessel lately, and another will be ready for putting off early in August. At Messrs. Swan and Hunter's yard, the construction of two vessels that had lain in an uncompleted state for a couple of years, has been resumed. As there are four other vessels in progress, the yard is very busy. Since last month a very distinct change for the better has taken place at Messrs. Hawthorn & Leslie's yard. In addition to the two vessels which are being built for a Newcastle firm, a steamer of exceptionally large dimensions has been laid down, and it is understood that the firm have a sister ship to proceed with. They have also booked an order for a China steamer of medium size, in respect of which, it is stated, the competition by rival firms has been very keen. In addition to this large amount of new work the firm have two very extensive repair contracts in hand. At Messrs. Palmer's yard, Jarrow, business is still dull, the vessels in course of construction not being sufficiently advanced to require the services of many men. The Tyne Shipbuilding Company have one vessel on the stocks, and it is understood that they have other orders. Messrs. Readhead have three berths occupied, all the vessels being of large tonnage. The Tyne Pontoons Company, and the Wallsend Slipway Company, have each important repair contracts on hand. Messrs. Edwards have also a very heavy contract of this description in progress. No material change has taken place since last month in the state of matters at the Elswick yard. In the engineering trade business still shows an improving tendency. The North-Eastern Engineering Company, Wallsend, who have done very little in their admirably arranged new works for some time past, are reported to have secured some good orders for marine work. At all events they have set several pattern makers to work, and they are now putting on men in the other departments. In almost all the other marine engineering establishments business has sensibly improved. Messrs. Hawthorn & Leslie's forge at Hebburn is quite full of work, and a night shift has been put on. The firm have lately been engaged in manufacturing a number of wrought iron crank shafts, which it is understood are to supersede certain cast steel shafts which, on examination, were found not to come up to the necessary requirements. The Wallsend Forge is also busy, mainly with marine engine work, and some other forges are doing well. At the Tyne Boiler Works, the s.s. *Lionel*, of Newcastle, is having new boilers supplied [Lloyd's survey, No. 3], and is otherwise being altered and repaired. Messrs. Eltringham are also supplying new boilers to a couple of steamers. Mr. George Tyzack, of South Shields, is just now engaged in manufacturing a large number of his patent anchors for torpedo service. One hundred of these have been despatched from the works during the month, and a much larger number will shortly be ready for sending away.

The Wear.—During July six vessels, having an aggregate tonnage of about 12,000 tons, were launched on the Wear, but in no instance was there a keel placed in the vacated berth. Messrs. Short Brothers' is now the only yard on the river which shows any approach to business. In this instance there are four large vessels (ordered by local owners) in progress, and it is known that there are others to be laid down. The firm, for some time past, have been steadily improving their resources by providing additional plant, and so far as competitive ability is concerned, they are now in a position of thorough effectiveness. The last vessel launched from the Deptford yard was for French owners, and is now being fitted out in the river. It is intended for passengers as well as cargo traffic, and being constructed on fine lines, is a very handsome specimen of the shipbuilders' art. At the time of writing there are only two vessels on the stocks, both of which are nearly completed, and as a consequence a condition of unusual slackness exists in the establishment. The firm have, however, recently secured some contracts, and preparations are now being made for proceeding with the execution of one of them, a vessel of some 3,000 tons burthen. The firm are putting doubling strakes, and otherwise altering and repairing the s.s. *Chancellor* (owned by themselves), and they are also doing some less extensive repairs to other vessels. Messrs. R. Thompson & Sons continue to do a good deal of repairing work, and their graving dock at Sunderland Bridge is seldom empty. Messrs. J. L. Thompson & Sons launched a vessel built to the order of London owners on the 21st inst., and there is now but one vessel which is in an advanced stage of construction on the stocks. Frame turning for a 3,000-ton steamer has, however, been commenced, and this vessel will very soon occupy one of the berths. Messrs. Blumer and the Sunderland Shipbuilding Co. have each sold a vessel that had lain on their hands for a year or more, and it is satisfactory to find that these sales have reduced the number of unsold steamers in the port to 5, the number on local builder's hands at this time last year having been 23. A large proportion of the vessels that have been sold have passed into the hands of foreign ship-owning firms. The state of work in the engineering works is very unequal, two of the larger establishments being well employed, while at a third (the Palmer's Hill Works) it has been found necessary to reduce the working staff. The concern last referred to, however, has been very busy during the earlier part of the year, when the others were slack. In the smaller engineering establishments business is generally dull, and in the foundries there is little doing. Two of the local forges are pretty busy, but the others are standing idle, and the plant, &c., at one of these establishments has been advertised for sale. Messrs. Lumsden's chain and anchor works, after having been idle for about two years, have again been put in operation. The plant and general working accessories of the establishment have been greatly improved, and there is reason to believe that the new departure will be in every way successful. The Fulwell Iron Works, though not uniformly in full operation, may be said on the whole to be doing a satisfactory business, especially when the dull state of matters in similar works elsewhere is taken into account.

The Hartlepools.—Messrs. W. Gray & Co. launched a large steamer during the month to the order of Messrs. Watts, Ward and Co., London, and they have a sister ship, ordered by the same firm, in frame. There are two other vessels on the stocks, and three in preparatory stages. Messrs. Withy have also a considerable amount of work in hand, and future prospects are fairly good. The Central Marine Engine Works continue to be kept steadily going. The s.s. *Hampstead*, recently launched by Messrs. W. Gray & Co., is being engined beside the works. Messrs. Richardson's establishment is also busy, and is being considerably extended.

The Tees.—Messrs. Raylton, Dixon & Co., having launched a large vessel lately, have now only two vessels on the stocks besides a couple of hopper barges. The firm, however, have completed several important repair contracts during the month. Messrs. Craig & Taylor, of Stockton, have just launched the last vessel on their stocks, excepting a small steamer which is unsold. The firm have, however, obtained an order for a passenger steamer of medium size, and this will shortly be in progress. The construction of a large vessel at Messrs. Pearse & Co.'s yard is greatly hindered through the absence of material. With the exception of one or two large foundries at Middlesbro', and Messrs. Blair & Co.'s engine works at Stockton, engineering, iron founding, and bridge building establishments in this locality are short of work.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Queen Marfisa.—On June 21st there was launched from the shipbuilding yard of Messrs. W. White & Sons, Cowes, a steel screw steam yacht of 175 tons builders' measurement, to class 100 A1 at Lloyd's. Her dimensions are 118 ft. long, 112 ft. on the water-line, 17 ft. beam, and 12 ft. 6 in. deep. The vessel is fitted with a pair of compound surface-condensing engines of 42 H.P., cylinders 16 in. and 32 in., with an 18 in. stroke. The boiler is also of steel, and she is fitted up with all the latest improvements. The yacht has been built to the order of G. Beer, Esq., of Canterbury. The christening ceremony was performed by Miss Beer, daughter of the owner, and the yacht was named the *Queen Marfisa*.

Minister Maybach.—On June 23rd there was launched from the Low Walker shipbuilding yard of Sir W. G. Armstrong, Mitchell & Co., a steel screw steamer specially constructed for the carriage of petroleum in bulk across the Atlantic. The vessel is capable of carrying 3,000 tons of oil, besides fuel and stores, on a moderate draught of water. She is built on what is known as Swan's conical bottom system, one of the important conditions of which is that the vessel will carry an ample quantity of ballast for an Atlantic voyage, without it being necessary to carry ballast water in the compartments intended for oil carying. The system, moreover, gives great facilities for trimming the vessel under various conditions, and provides for any oil or gas which may leak into the ballast compartments being absolutely expelled. The vessel will be fitted with two sets of Worthington pumps, with complete installations. On leaving the ways she was named the *Minister Maybach* by Mrs. Falkenberg, wife of the chief engineer of the steamer, and immediately after the launch the vessel was taken to the works of the Wallsend Slipway and Engineering Company, where she will be fitted with machinery manufactured on the triple-expansion system, with all the latest improvements for economy of fuel, and capable of propelling her at a speed of 10 knots an hour. She will also have a complete electric light installation by Messrs. Clarke, Chapman, Parsons and Co., Gateshead, and generally speaking be fitted up in a most complete manner for her service.

Ville de Metz.—On June 23rd there was launched from the yard of Mr. James Laing, at Sunderland, a handsome steel screw steamer, built to the highest class of Lloyd's and Veritas for the Compagnie Havraise Peninsulaire, of Havre. This steamer is of 4,500 tons capacity, her length for register being 350 ft., breadth 42 ft., and depth, moulded, 29 ft. 6 in., with cellular double bottom. She has two decks of steel and iron, and one of wood, full poop, topgallant forecastle and long bridge, and is fitted for a number of first and second class passengers. The vessel is strengthened with web frames, and has a large hatchway for carrying boilers, &c. She will be fitted with triple-expansion engines by Mr. George Clark, of about 2,000 I.H.P., equal to a speed of 13 knots. Among the gentlemen present at the launch were Mr. P. Grosos (one of the directors of the company), Mr. Laing, Mr. Arthur Laing, Mr. Collet, Mr. Sparks, Mr. Swainston, Mr. Mattison, and other gentlemen and a number of ladies. The vessel on leaving the ways was named by Miss Julia Swainston the *Ville de Metz*.

Olinda.—On July 2nd there was launched from the shipbuilding yard of Messrs. J. Blumer & Co., North Dock, Sunderland, a finely-modelled steel screw steamer, which has recently been sold to a foreign firm. The vessel is built under Lloyd's special survey. The principal dimensions are as follows:—Length, b.p., 250 ft.; breadth, 36 ft.; depth, moulded, 19 ft. She is estimated to carry about 2,000 tons, and is intended for the general trade. She is fitted with windlass and winches by Messrs. Clarke, Chapman & Co., and Davis's steam-steering gear fitted amidships. The engines are of the triple-expansion type, of 150 N.H.P., and are by the North-Eastern Engineering Company. As she was leaving the ways she was gracefully christened the *Olinda* by Mrs. Wm. Blumer.

Kydonia.—On July 4th there was launched from the yard of the Sunderland Shipbuilding Co., Limited, an iron screw passenger steamer, 170 ft. by 25 ft. by 13 ft., classed 100 A1 Lloyd's, having poop bridge and topgallant forecastle. The vessel is intended exclusively for the passenger trade between Smyrna, Aivaly, and Constantinople, and is consequently built with very fine lines. The first-class passengers are berthed in the poop, which is fitted up in hardwood and tastefully decorated, the second-class accommodation being forward; all berths are large and roomy, particular care having been given to complete ventilation. The machinery is by the North-Eastern Marine Engineering Co., Limited, upon the three-crank tri-compound principle, having cylinders 15 in., 25 in., and 40 in. by 24 in. stroke, and working at a pressure of 150 lbs. per square inch. During her construction the steamer has been inspected by Capt. Caractarjam, and the engines by Mr. Stelliano. Upon leaving the ways she was named *Kydonia* by Miss Carter, of Sunderland.

Bengal.—On July 6th there was launched from the shipbuilding yard of Messrs. Craig, Taylor & Co., of South Stockton, a new steel screw steamer built to the order of Mr. Joseph Hoult, Liverpool. She has a capacity for 2,500 tons of cargo, and will be fitted with triple-expansion engines by Messrs. Carr & Co. (Limited), Sunderland, the cylinders being 18 in., 29 in., and 48 in. in diameter by 36 in. stroke. The vessel was christened *Bengal* by Miss Pyke, of Liverpool.

Picton.—On July 6th Messrs. Edward Withy & Co., West Hartlepool, launched the steel screw steamer *Picton*, built to the order of Messrs. R. Ropner & Co., West Hartlepool. She is a vessel of 300 ft. in length, with a large deadweight carrying capacity, and built to 100 A1 class at Lloyd's. The vessel has a long raised quarter deck, short poop, long bridge house and a topgallant forecastle, and is built on the web frame system. The main, bridge, and quarter decks are of iron and steel, the charthouse, cabin skylight, engine room skylight, bulwarks, rails, galley, grain divisions, and four watertight bulkheads of iron. The steamer is fitted with Withy and Sivewright's patent improved cellular double bottom for water ballast all fore and aft; four steam winches, patent windlass, and two donkey boilers by Clarke, Chapman & Co.; stockless anchors hauling up into hawse pipes; hand and steam gear amidships by Davis & Co.; and Hastie's right and left hand screw gear aft. The vessel is rigged as a two-masted fore and aft schooner with iron lowermasts, and she will be fitted with triple-expansion engines by Messrs. Blair & Co., Stockton-on-Tees. On leaving the ways the vessel was gracefully christened *Picton* by Miss Ropner.

Riverina.—On July 6th, a large screw steamer, built of steel, was launched from Messrs. Wigham Richardson & Co.'s shipyard at Low Walker. The vessel, which has been built to the order of Mr. W. Lund, of London, for his Australian Line, is 340 ft. long, 40 ft. beam, and 29 ft. deep. She will have her poop and 'tween decks fitted up throughout for passengers, and will besides carry fully 4,000 tons of cargo. After the launch the vessel was moored alongside the Neptune Engine Works to receive her engines, which are of the builders' own make (Tweedy's patent), and of 2,000 H.P. The vessel was christened by Mrs. Lund, wife of the owner, and named the *Riverina* after the well-known wool district in Australia.

Furao.—On July 7th the s.s. *Furao* was launched on the Mersey, from Messrs. J. F. Waddington & Co.'s shipbuilding and

engineering works, at Seacombe, Liverpool. This vessel has been built for towing and general passenger trade at Lisbon, and is built of steel throughout. Length, 70 ft.; breadth, moulded, 12 ft.; depth, moulded, 7 ft. She is fitted with two neat cabins, well ventilated by large teak skylights, in addition to the crew accommodation. The engines are inverted compound surface-condensing, having cylinders 12 in. and 24 in. diameter by 18 in. stroke, steam being supplied at 100 lbs. pressure from one of the above firm's special horizontal marine boilers, as successfully fitted in many other vessels built by them. The trial trip took place off the Mersey, July 13th, the *Furao* showing herself capable of a speed of 11 knots; and she sailed the following day for Lisbon, carrying on board 16 tons of coal, sufficient for the run out on a mean draught of 5 ft. This is the eleventh vessel launched this year by Messrs. J. F. Waddington & Co.

Hampstead.—On July 7th Messrs. W. Gray & Co. launched from their yard a steel screw steamer of the following dimensions:—292 ft. length overall, 37 ft. 6 in. beam, 22 ft. 3 in. depth moulded, built to the order of Messrs. Watts, Ward & Co., London. The vessel takes Lloyd's highest class, and has large carrying capacity. She is of the improved well decked type, having the bridge extended forward of the main hatch. The poop aft contains handsome saloon and accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore part of the bridge. Emerson, Walker & Co.'s steam windlass is fitted forward with a capstan extending above the topgallant forecastle. The hull is built with web frames, giving strong sides, and dispensing with hold beams, thus avoiding any obstruction in the working of cargo. A cellular double bottom is fitted for water ballast throughout. Five hatches, two donkey boilers, four steam winches, and steam steering gear are fitted, and the ship is thoroughly equipped as a general trader. The engines, which are on the three cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co., Limited, Stockton-on-Tees. The vessel and machinery have been superintended during construction by Captain Hodgson and Mr. Alchin respectively, on behalf of the owners. The christening ceremony was gracefully performed by Miss M. Emley, Ellison Place, Newcastle-on-Tyne, the vessel being named *Hampstead*.

Tartar.—On July 7th there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., a steel steamer, which has been built to the order of Messrs. Gellatley, Hankey, Sewell and Co., London, for their China trade. Her leading dimensions are:—332 ft. overall, breadth, 38 ft. and 27 ft. depth, moulded. She is built on fine lines, and will have a carrying capacity of over 4,100 tons of tea. She has long bridge, topgallant forecastle, poop aft for accommodation of passengers, her officers and engineers being arranged under the bridge. Water ballast in double bottom in after hold and under engines, teak decks especially strong, and ample cargo discharging gear makes her a ship especially adapted for this particular trade. She will be fitted with engines by Messrs. Thos. Richardson & Sons, of Hartlepool, built on the triple-expansion principle, having cylinders 26 in., 42 in., and 69 in. by 42 in. stroke, capable of developing 1,700 I.H.P. She carries a very powerful capstan windlass, horizontal type, by Emerson, Walker & Co. On leaving the ways she was christened the *Tartar* by Miss Stodds, of Hartlepool.

Japigia.—On July 8th there was launched from the shipbuilding yard of the Sunderland Shipbuilding Co., Limited, an iron screw steamer 220 ft. by 30 ft. 6 in. by 16 ft. 9 in., classed 100 A1 Lloyd's, having long full poop to forward of engines. This vessel has large passenger accommodation in the long full poop, with a dining saloon in a large house upon the poop deck, which is fitted up in hardwood. The machinery is by the North-Eastern Marine Engineering Co., Limited, upon the three crank tri-compound principle, having cylinders 17½ in., 29 in. and 50 in. by 30 in. stroke, working pressure 150 lbs. per square inch. A windlass of the vertical type, by Messrs. Emerson, Walker & Thompson Brothers, of London and Gateshead, will form part of the equipment. This vessel has been constructed specially for passenger trade, and is owned by the Puglia Steam Navigation Co. of Bari, Italy, and will be used upon their regular line. During her construction she has been inspected on behalf of the owners by Capt. Gallo, who also named her *Japigia* upon leaving the ways.

Engineer.—On July 21st there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., a steel steamer which has been built to the order of Messrs. Tatham, Bromage and Co., of London, for the Engineer Steamship Co., Limited. Her dimensions are:—Length, 196 ft., breadth, 28 ft., depth moulded, 14 ft. 7 in. She is specially built for carrying large and heavy pieces of machinery, without any beams in her holds, having one large hatchway 62 ft. long by 12 ft. 6 in. She is fitted with water ballast, &c., as complete cargo boat, and in addition will have powerful shear legs fitted on deck for the purpose of lifting and stowing heavy pieces of machinery, boilers, &c. She will be fitted with triple-expansion engines of 120 H.P. by George Clark, Esq., of Sunderland. On leaving the ways she was christened the *Engineer* by Mrs. Oxenham, of London.

Iron Screw Steamer.—On July 23rd Messrs. Richardson, Duck and Co. launched from their building yard an iron screw steamer of the following dimensions:—Length over all, 286 ft.; length between perpendiculars, 277 ft.; breadth extreme, 37 ft. 5 in.; depth in hold, 20 ft.; gross tonnage, about 2,125 tons. The vessel is classed 100 A1 on Lloyd's registry, and has been built under special survey. She has a short half poop with accommodation for captain; a quarter deck extending to engine room; a bridge over engines and boilers, and extending to foremast, the after end of bridge being fitted up with accommodation for officers and engineers, and a topgallant forecastle fitted up for crew. Water ballast tanks on the cellular principle extend from the after peak bulkhead to the fore end of the main hold. The vessel is supplied with four steam winches, and Emerson and Walker's patent windlass. Her engines of the triple-expansion type by Messrs. Blair & Co., Limited, are of 170 H.P. with cylinders 21 in., 35 in., and 57 in. by 39 in. stroke, working pressure 160 lbs.

LAUNCHES.—Scotch.

David.—On June 22nd Messrs. Russell & Co., Greenock, launched a screw steamer of 250 tons net, of the following dimensions:—Length, 130 ft.; breadth, 25 ft.; and depth, 7 ft. 9 in. On leaving the ways she was named *David*. She has been specially designed for the Panama coasting trade. After the launch the *David* was taken to the James Watt Dock to have her masts put in by her builders, and be engined by Messrs. Kincaid and Co., Clyde Foundry, Greenock.

Tasso.—On June 22nd Messrs. Russell & Co. launched from their Greenock yard a powerful screw steamer of 2,900 tons gross, and of the following dimensions:—Length, 320 ft.; breadth, 40 ft.; and depth (from top of keel to main deck), 21 ft. 7½ in. On leaving the ways the vessel was named *Tasso* by Miss Kennedy, Kilmarnock. The steamer has been constructed to the order of Messrs. R. M'Andrew & Co., shipowners, London, and will be engined on the triple-expansion principle by Messrs. Houston & Co., of Glasgow. After being fitted out for sea at the James Watt Dock, she will be employed in the Spanish and Montevideo general carrying trade, under the command of Captain Henry Dilley.

Malikah.—On July 7th Messrs. Ramage & Fergusson, Leith, launched a very fine iron screw steam yacht named the *Malikah*, a vessel of about 320 tons, which has been built to the order of Mr. H. J. Barrett, of Maldon, Essex, owner of the steam yacht *Avalanche*. The new yacht, which has been designed by Mr. Edwin Wilkins, of Wivenhoe, has a round and a raking cutwater, with two masts fitted in tabernacles on deck. Her engines are of the triple-expansion type, and having cylinders of 15 in., 24 in., and 39 in. in diameter respectively, with piston stroke of 24 in.

Wardha.—On July 7th Messrs. Alexander Stephens & Sons launched for the British India Steam Navigation Co. a splendid steel screw steamer, 350 ft. long, 47 ft. beam, and 28½ ft. deep, about 4,000 tons gross, built under special survey to Lloyd's 100 A1 spar deck class. The vessel was named the *Wardha* by Miss Stephen, 12, Park Terrace, Glasgow. The *Wardha* has three complete decks, the spar and main being of steel throughout, and she is divided by six watertight bulkheads all running up to spar deck. The vessel has a deadweight carrying capacity of about 5,000 tons, and from the large and roomy 'tween decks afforded by her great breadth of beam, should prove a valuable addition to the list of vessels for Admiralty transport service, and for which she has been specially surveyed. The accommodation for first-class passengers and officers is contained in a centre citadel house. The state rooms which are unusually large, well lighted and ventilated, will be replete with all modern conveniences for the comfort of their occupants. The saloon is finished in polished hardwood, and will be furnished complete and richly upholstered. A handsome tiled fireplace with marble mantelpiece, flanked on each side with cabinets and bookcases of chaste design, is fitted at fore end of saloon. The officers' cabins which are fitted at sides of after end of citadel house, are large, airy, and comfortably

furnished apartments, all the fittings being in hardwood. On the bridge deck there are two large deck houses finished in teak, the forward one forming wheelhouse, with captain's cabin and entrance to saloon by large staircase; the after house is fitted up as a smoking room with upholstered seats and marble tables. The after end of the vessel is covered in with a turtle back of steel, having a house in continuation in which is fitted superior accommodation for second-class passengers. Sailors, firemen, and petty officers are located in topgallant forecastle forward, having all conveniences for their comfort. All the most recent and approved appliances have been introduced for the efficient handling of ship and cargo, including eight steam winches, steam and hand steering gear, steam windlass, lighthouses, &c. Provision has also been made for about 850 tons of water ballast in double bottom under engines and boilers, and in deep tank abaft engines which is also available for cargo. A complete installation of electric lighting has been fitted throughout cabins, holds, engine room, and stokeholds by Messrs. Andrews of Glasgow. The engines, also made by the builders and fitted on board before launching, are of the most improved triple-expansion type, having cylinders, 25 in., 41 in., and 67 in. by 48 in. stroke, steam being supplied by two large double-ended boilers suitable for a working pressure of 160 lbs. Messrs. Stephen have a sister ship in an advanced stage of construction for the same company, and which will be launched in about six weeks.

Elettrico.—On July 11th Messrs. Alexander Stephen & Sons launched from their shipbuilding and engineering works at Linthouse a beautifully modelled steel screw steamer 250 ft. by 33 ft. by 23 ft. 1½ in., and about 1,250 tons gross, for the Navigazione Generale Italiana, of Rome, for their mail and passenger service between Naples and Palermo. The vessel being for a mail service where great speed is a desideratum, she has exceptionally fine lines. She has clipper bow, having handsomely carved and gilded figurehead, name and trailboards, while the stern is richly adorned with carving, giving the vessel more the appearance of a large yacht than a merchant vessel. She has been built with scantlings in excess of Lloyd's 100 A1 class under special survey. The 'tween decks, which are very lofty, have been entirely fitted up for first, second and third class passengers, officers and crew. The first class accommodation is all fitted up before the engine space. Great attention has been given to the arrangement of the state rooms to make them comfortable and elegant apartments, the beds being specially large and in the form of sofas very richly upholstered with spring seats and backs. All the passages leading to the rooms are in polished maple with rosewood mouldings, pilasters and gilt cornices. The first class saloon, which extends the full breadth of the vessel, is a beautiful apartment finished in polished hardwood, and furnished in a very luxurious manner, while the floor is laid with parquetry of a neat design. The saloon is lighted and ventilated by numerous large nickel-plated sidelights, and by a large well opening through house on deck. Entrance to saloon and first class cabins is obtained through a deckhouse, with a grand stairway surrounded by a railing formed of fluted glass balusters with E. P. fittings. Adjoining this stairway is a Social Hall, while the fore part of the house contains accommodation for the captain. Abaft the engine hatch there is another steel deckhouse forming entrance to second class cabins and officers' rooms. The accommodation for second class is of a superior description, and will be complete with all modern conveniences, while further aft are the third class passengers' quarters, which are light and airy. The officers' and engineers' rooms are ranged on each side of engine and boiler space, and are fitted and furnished in keeping with the high class of the other accommodation. The whole vessel is fitted out and furnished in a most elaborate and elegant style, markedly superior to the ordinary type of passenger steamers. She will be schooner rigged with two steel pole masts, and fitted with steam and hand steering gear, steam windlasses of the horozontal type, by Messrs. Emerson, Walker & Co., steam winches, and all appliances for efficient working of ship and light cargo. The engines, also made by Messrs. Stephen, are of the most improved triple-expansion type, having cylinders 30 in., 48 in., and 77 in. diameter by 48 in. stroke, with two large steel boilers suitable for a working pressure of 160 lbs., and having provision for forced draught. She has also been fitted throughout with a complete installation of electric lighting by Messrs. Andrews, of Glasgow. She is the sixth steamer built by Messrs. Stephen for the same owners, and as in previous cases the good taste of Captain Diliberto, the superintendent of the company, has contributed largely to the design and finish of the vessel. As she left the ways she was gracefully named the *Elettrico* by Signora Diliberto.

LAUNCHES.—Irish.

Michigan.—On July 5th there was launched from the shipbuilding yard of Messrs. Harland and Wolff at Belfast, a fine screw steamer, named the *Michigan*. She has been built to the order of Messrs. George Warren & Co., Liverpool, her dimensions being:—Length, 400 ft.; breadth, 47 ft.; depth, 26½ ft.; and having a gross registered tonnage of about 5,000. She is constructed of steel, and built under special survey, having the highest class in Lloyd's and also in "Bureau Veritas." She will be propelled by engines of the latest type of triple-expansion, and will be capable of indicating upwards of 3,000 H.P. The steamer is intended for trading in the company's regular line between Liverpool and Boston. She is fitted with four masts, has handsome saloon and passenger accommodation, and is specially designed, like all ships of this line, for carrying large consignments of cattle. She has been fitted out in the most improved fashion, having a powerful steam windlass for lifting anchors, &c., and also steam winches and steering gear of the most modern description. As the vessel left the ways the ceremony of christening was gracefully performed by Miss Massey, of Liverpool, daughter of one of the firm of Messrs. Warren.

Foyle and Victoria.—On July 6th there were launched from the new shipbuilding yard of Mr. Charles J. Bigger, at Londonderry, two steamers built within the past six months. Much public interest was manifested in the proceedings, the event being regarded as the revival of an industry that formerly flourished in Derry, but has been dead for the last thirty years, and the launches were witnessed by some thousands of spectators on shore and afloat. The vessels were the *Foyle*, a steel screw steamer of 400 gross tonnage, built to order of Messrs. William Johnston & Co., of Liverpool, and to be used in the Mediterranean trade. She is 170 ft. in length, 23 ft. 6 in. breadth, and 11 ft. 9 in. depth of hold. She is to be fitted in Glasgow by Messrs. Dunsmuir and Jackson with triple-expansion engines of 600 H.P. She has been built under special survey in excess of Lloyd's highest class. The second vessel was named the *Victoria*, a ferry steamer, for the Foyle, designed by Mr. Wilson, of Holywood, and built to the order of the Londonderry Bridge Commissioners. She is 50 ft. in length, 9 ft. beam, and 5 ft. in depth, and accommodates eighty passengers. She has compound condensing engines, and is capable of a speed of nine knots an hour. The vessels were launched immediately after each other, and took the water splendidly. The ferry steamer, which had been engined and fully equipped before the launch, immediately got up steam, and gave proof of her capabilities in the matter of speed and rapid turning. Mrs. J. M. Rodgers performed the ceremony of christening the *Foyle*, and a like service was done the *Victoria* by Miss Scott, daughter of the chairman of the Bridge Commissioners.

TRIAL TRIPS.

Electrician.—On June 25th the s.s. *Electrician* proceeded on her trial trip from Middlesbro' dock. This vessel is the fifth built by Messrs. Raylton, Dixon & Co., Cleveland Dockyard, Middlesbro', to the order of Messrs. Thos. & Jas. Harrison, of Liverpool, and is specially adapted for their Calcutta trade. Her leading dimensions are:—Length 337 ft., breadth 40 ft., depth 29 ft. 2 in., and she has a carrying capacity of over 4,000 tons. She is built entirely of steel to Lloyd's highest class, with Board of Trade certificate for passengers, and is specially complete in all her arrangements for cargo loading and discharging. She has hood aft with deckhouse containing saloon and state rooms for accommodation of passengers, long bridge amidships, and topgallant forecastle. Her engines are by Blair & Co., Limited, of Stockton, on triple-expansion principle, having cylinders 24 in., 40 in., and 66 in., and stroke 45 in., and indicate 1,500 H.P. The trial trip proved in every respect most satisfactory, and she attained a speed of 12 knots.

Albania.—The steel screw steamer *Albania*, the third and last of the Greek Royal Mail steamships built by Messrs. Archibald M'Millan & Son, Dumbarton, went on a cruise at the beginning of July to have her speed tested when fully loaded. The other two like vessels, the *Iona* and *Thrace*, performed their trials some time previously, and the results from each have been similarly satisfactory. Each carried over the weight guaranteed, and performed the speed undertaken by the builders, and a third of a knot over the guaranteed rate of 12 knots when loaded as a mean of the means of six runs on the measured mile at Skelmorlie. These vessels have been designed to carry the mails, about 100 first and second class passengers, and cargo for the Greek service, and are

also adapted to fulfil the requirements of the Royal Greek Government as transports for troops and for the torpedo and defensive service of the country. They have been built and completed within six months, and are capable of carrying 2,000 tons of dead weight. They have triple-expansion machinery of 1,750 I.H.P., by Messrs. D. Rowan & Son, Glasgow, and when moderately loaded have a speed of 14 knots. The vessels are fitted with all modern improvements in machinery, including Weir's feed-heater and accessories. The steam steering-gear is on the principle patented by Messrs. Alley and MacLellan.

Moselle.—On July 4th the twin screw-steamer *Moselle*, recently launched from the dockyards of Messrs. Archibald M'Millan & Son, Dumbarton, left the river for Marseilles, after having undergone the trials of her machinery for speed and consumption of fuel, which proved entirely satisfactory. The *Moselle*, which is of dimensions 145 ft. by 22½ ft. by 11 ft., and a gross register tonnage of 315 tons, is fitted with accommodation for a considerable number of passengers, and is intended for the Armenian and Mediterranean coasting trades of her owners, Messrs. N. Paquet & Co., of Marseilles. The machinery, which is on the compound principle of 440 I.H.P., was constructed by Messrs. Scott & Co., Greenock, and the speed attained was over 11 knots.

Benholm.—On July 6th the *Benholm*, launched by Messrs. Craig, Taylor & Co., shipbuilders, Stockton-on-Tees, to the order of Mr. Joseph Hoult, of Liverpool, had a most successful trial trip at sea. A speed of over 10 knots was attained. She is built for the Demerara sugar trade, or American cotton trade. She is fitted with triple-expansion engines, with cylinders 18 in., 29 in., and 48 in., and 36 in. stroke, pressure 150 lbs., by Messrs. Carr & Co., Limited, Sunderland. Both ship and engines performed their work very satisfactorily.

Empress.—On July 12th the large steel paddle steamer *Empress*, built to the order of the London Chatham and Dover Railway Company, for their service in the English Channel, by the Fairfield Shipbuilding and Engineering Company, Limited, was run over the measured mile at Skelmorlie, on the Firth of Clyde. Notwithstanding the high head wind that was blowing and the heavy sea that was running at the time, the vessel attained a speed of 21·3 knots per hour. The vessel measures 325 ft. by 34 ft. 9 in. by 22 ft. to upper deck, and is divided into eight water-tight compartments. She has a gross register of 1,200 tons, and is similar in design to the *Victoria*, which was built in the same yard last year. There is a rudder at each end to facilitate the movements of the vessel in entering and leaving harbours. The vessel is supplied with a set of compound diagonal direct-acting engines, and the boilers, which are constructed of steel, are adapted for a working pressure of 110 lbs. per square inch. She is fitted with an electric light installation, and is otherwise most completely equipped.

General Tajos.—On July 12th the Paisley-built steam screw tug *General Tajos* went on her trial trip. She was built by the Abercorn Shipbuilding Company, and engined by Messrs. Hanna, Donald & Wilson. A general speed of 12 miles was attained, which was considered very satisfactory. The steamer is 80 ft. long, 18 ft. 6 in. broad, and 9 ft. 6 in. deep, built to the order of M'Adams and Evans, of Rio Grand de Sul, Brazil. The builders have other orders in hand for the same firm. The engines have a working pressure of 90 lbs., with a 21 in. stroke. She has left for Brazil under the command of R. W. Wilkinson.

Halcyon.—On July 13th the new steel paddle steamer *Halcyon*, built by Messrs. John Scott & Co., at Kinghorn Shipbuilding Yard, and fitted out at Kirkcaldy, left for London after a most satisfactory trial of her speed, which indicated 17 knots per hour. The *Halcyon* has been built to the order of the General Steam Navigation Company, and is specially adapted for their passenger trade between London, Harwich, and Yarmouth. She is a boat of the following dimensions:—220 ft. long, 26 ft. broad, and 9 ft. deep. She is fitted with engines of 1,300 H.P., with a stroke of 33 and 62 by 5 ft., on the diagonal surface-condensing principle. Included in the deck outfit of this vessel is one of Emerson, Walker & Co.'s patent windlasses, specially arranged for working wire rope cable, on one side, this new patent wire rope cable lifter grips firmly without doing injury to the cable.

Oronsay.—On July 14th the trial trip of the steamer *Oronsay* took place. She is the second vessel built by Messrs. Charles Connell & Co., Whiteinch, for Messrs. James Gardiner & Co., Glasgow. Dimensions, 282·0 by 37·0 by 20·6. The engines are on the triple-expansion principle, and were constructed by Messrs. John and James Thomson, Finnieston Street, and fitted with Weir's feed heaters and pumps, and all the latest improvements. The *Oronsay* is built of steel, and is fitted with steam steering gear, steam windlass, &c. The vessel on trial attained an average speed of 10¾ knots, which was considered highly satisfactory.

Gem.—On July 16th this handsome steamer, recently launched by Messrs. John Fullerton & Co., Paisley, went down the Clyde on her official trial trip. Compasses being adjusted, the owner and a numerous company joined the steamer at Greenock, which at once proceeded to run the lights between Cloch and Cumbrae and *vice versa*, which was done at the rate of 11½ knots per hour, a rate of speed which was much in excess of what was anticipated. The *Gem* has been built to the order of Mr. Wm. Robertson, 88 Great Clyde Street, Glasgow, and is the seventh steamer which Messrs. John Fullerton & Co. have supplied for that gentleman. She is built with a double bottom on the cellular principle, and carries a large quantity of water ballast, which is discharged by a pulsometer, has steam steering-gear on bridge and flying bridge, Smith's patent anchors, &c. The engines, which are supplied by Messrs. Wm. King & Co., Dock Engine Works, Glasgow, are on the triple-expansion three-crank principle, and are the first set which that firm has built. The engines have all the latest improvements. Steam is supplied by a large horizontal tubular boiler, working at a pressure of 160 lbs., having a Gilmour's feed-heater attached. The engines worked admirably during the whole trip, and developed a very high I.H.P.

Holme Force.—On July 16th the s.s. *Holme Force*, recently launched by Messrs. R. Williamson & Son, Workington, and engined by Messrs. Dunsmuir & Jackson, Govan, went down the river on her trial trip. She is fitted with a set of triple-expansion engines of the latest design, having all the modern improvements, and working at a pressure of 150 lbs per square inch. After adjusting compasses at the Garelock, she proceeded to Skelmorlie to run the measured mile there, attaining a speed of 10 knots on a very low consumption of fuel. The machinery worked with the utmost smoothness and regularity, and gave entire satisfaction to every one on board. The *Holme Force* sailed for Workington immediately after the trial trip.

Kydoniai.—On July 20th the iron passenger steamer *Kydoniai*, built to the order of Mr. Georgalas, Aivaly, Asia Minor, by the Sunderland Shipbuilding Co., Limited, went on her official trial trip to sea. The dimensions of the vessel are 170 ft. by 25 ft. by 13 ft. classed 100 A1 Lloyd's, having topgallant forecastle for crew, open bridge and full poop which is fitted up with 16 beds for first class passengers, and sofa beds for 10 in addition. The saloon is entirely fitted in polished hardwood, and upholstered in velvet. The second class accommodation is placed forward for 24 passengers, the whole of the berths being specially large and well ventilated. The vessel is fitted up in the most modern style, having direct acting steam windlass by Messrs. Emerson and Walker, patent steam steering gear by Messrs. Davis & Co., London, and steam winches by Messrs. Welford Bros. The main engines are built by the North-Eastern Marine Engineering Co., Limited, Sunderland, and are upon the three crank tri-compound principle, having cylinders 15 in., 25 in., and 40 in. by 24 in. stroke, and working at a pressure of 150 lbs. per square inch. The steamer is specially constructed for the passenger trade between Smyrna and Constantinople, and was taken to sea with the view of fulfilling her guaranteed speed of 12 knots upon a guaranteed consumption. The steamer was first run from Sunderland to the Tyne, and after making several runs upon the measured mile, was again run from the Tyne to the Wear, the average speed of the runs being 13 knots per hour, and the consumption very much less than that guaranteed. During the whole of the runs the machinery worked with perfect smoothness, and the full boiler pressure was easily maintained. The times were accurately taken by Mr. Glover, of Liverpool, and Capt. Caracatayanis on behalf of the owner, both of whom were fully satisfied with the results obtained.

Harvestoe.—On June 25th the trial trip of the *Harvestoe* (s) took place over the measured mile at Whitby. The vessel, which was launched some weeks ago, has been built by Messrs. Doxford to the order of Messrs. Bennet & Sons, of Grimsby, and is a very fine specimen of a cargo boat. The trial was in every sense satisfactory, the vessel making over 11 knots an hour with the propeller only partially submerged, a rate of speed which, under the circumstances, was considered exceptionally good.

Gwynfaen.—The *Gwynfaen*, which has been built and engined for Messrs. Kneeshaw, Lupton & Co., by Messrs. John Jones and Sons, of Liverpool, has had her trial trip between Llandudno and Liverpool. The *Gwynfaen* is fitted with steam steering gear and

other modern appliances. She has been built under the superintendence of Messrs. Ashlin & Ashbridge, and she has the highest classification at Lloyd's. From leaving the dock until her return to Liverpool the machinery gave perfect satisfaction, the speed of the ship by log and observation being 11 knots.

Theodora.—Last month the fine steel steam screw yacht *Theodora*, which was recently built by Messrs. Gourlay Brothers, Dundee, for Mr. J. T. Morton, of Caterham, Surrey, had her trial trip on the Tay. The run from the Buoy of Tay to the Bell Rock showed a speed of nearly 12 knots per hour. The *Theodora* has been built from the designs of Mr. J. H. Ritchie, of London, who also inspected her during her construction. She has steam steering gear and anchor-lifting gear by Messrs. Napier Brothers, Glasgow, and electric lighting by Messrs. Stephens & Smith, London.

Undaunted.—H.M.S. *Undaunted* (12), belted cruiser, steamed out of Plymouth Sound into the Channel recently for a final contractor's four hours' trial of her machinery with forced draught. The vessel was in charge of Captain H. H. Rawson, C.B., the navigation was conducted by Lieutenant E. Leak, and the officials from the Admiralty present were Mr. Thos. Soper, engineer from the steam branch of the Admiralty; the builders were represented by Mr. J. P. Hall, engineering manager; Mr. H. Williams, chief inspector of machinery; Mr. C. Rudd, second assistant to the chief engineer of the dockyard on behalf of their respective departments; on behalf of the ship the trial was watched by her chief engineer, Mr. E. Norrington, and Mr. C. G. Nicholls, constructor, was present to represent the constructive department of the dockyard. The vessel was ballasted with heavy weights in order to bring her down to her deep load line draught, the same as if she had all her stores, guns, ammunition, coals, and crew on board ready for sea. Her draught of water forward was 20 ft., and aft, 22 ft. The result of the trial was as follows:—Starboard engine horse-power, 4,204; port engine horse-power, 4,398; for both engines, 8,602, or 102 over the power contracted for, which was 8,500. The highest power obtained was 9,020, or 520 above what was contracted for. The speed of the ship on the measured mile was 19·4 knots per hour, which is the highest speed attained by any of Her Majesty's heavily armoured ships of war. The wave line was measured, and the curve proved that the protective belt was above and below the water line in the position as originally intended in the design. The stability of the ship was most satisfactory, and the machinery worked admirably throughout. The ventilation of the ship was also exceedingly satisfactory. The *Undaunted* is the second of five vessels of the same class ordered about two years ago by the Admiralty. Messrs. Palmer & Co. have done important work in completing the two vessels entrusted to them to build, and which are the first two of the five. They have thus completely demonstrated how rapidity of construction and excellence of workmanship can be easily combined. This vessel previously had a natural draught trial on the 5th inst., when she attained a speed of over 17 knots, and indicated 5,640 H.P. during the four hours' run, the maximum horse-power being 5,890, or 390 H.P. above the contract, which was 5,500.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

CORROSION AND PROTECTION OF STEEL AND IRON SHIPS FROM CORROSION.

To the Editor of THE MARINE ENGINEER.

SIR,—I read with much pleasure the valuable paper in your July number upon the above subject, and I am happy to be able to bear out from personal experience the principal facts of which it treats. In my opinion Mr. Lewes strikes near the root of the evil when he says lead paints have "nearly died out." It is a pity that this should be the case, as I have found the best way of coating iron and steel ships is to dock them a few months after beginning to run, the "bloom" upon the new plates being then more easily removable. Thoroughly clean, and coat; 1st, with purest refined red lead damped with fresh water to prevent running, and laid on with raw oil. 2nd, a coat of red lead in which to give body, about one-fourth of genuine white lead has been mixed.

Varnish paints may then be used of the nature most suitable to the vessel's employment.

This treatment may be objected to on the score of expense, and justly so too if required to be used on *every docking;* but this is not the case, as when a good coat of genuine lead is put on (by which I don't mean a mixture of earth and brick-dust), it is sufficient in future dockings to mend it where chafed.

A very sufficient reason for not trusting to the varnishes is found not only in the presence of rust barnacles, but in the almost entire absence of the varnishes when the vessel is examined in dry dock.

This being the case, it is for owners to decide whether their interests lie in the exclusive use of varnishes, and the consequent pitting of which most owners complain, or the alternative use of good paints, either of zinc, as recommended by Mr. Lewes, or of lead, as being cheaper than deterioration in plates and forgings.

This brings me to another important matter, about which I find a notice in the "Marine Engineering News" as far back as 1877, but upon which I have never seen anything very satisfactory. The subject is the corrosion of propeller blades, which has acquired more prominence since the recent more extended use of steel. Reports from the East incline me to believe that, even in the case of cast iron propellers, those upon steel ships in Eastern waters are far more rapidly eaten through than those upon iron ships; steel propellers more rapidly than cast iron ones, and steel and iron screw shafts more rapidly than either.

Coating parts of propeller blades with soft metals or enamels has not been attended with unqualified success. Before these can be applied most of them require the removal of the "skin" of the casting, which induces bad consequences to bare parts when the coating is renewed; while in application all require the blade to be heated, tending to set up local strains which should be studiously avoided. Paints are of very little use owing to ready removal by skin friction.

Shafts stand a much worse chance when once in the stern bush, as they are seldom removed for examination, unless on account of accident to propeller, or in order to renew *lignum vitæ* in stern bush. Coating shafts with solder applied with a soldering iron has been tried, and I await the results with interest, as I am not sure that even painting and serving with "houseline" before being put in place has secured general confidence.

In conclusion, having laid the results of my observation before your readers, I should be glad of any suggestion as to the certain and effective protection of propellers and shafts.

"VERNIER."

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—I am very sorry to see that "Excelsior," in his letter to your June number, should have let his feelings get the upper hand, and in his hurry to get into print to condemn "Uneducated Engineer," "Hon. Chief Secretary," and "James Cope," should have so forgot himself as to mix Latin, very bad French, science and humbug, in a muddle together. Of course, being called "a young man" would make anybody vexed, but to make unfounded assertions, and to call names, are just the boys' methods when a stronger than themselves is there. "Excelsior" says Mr. Barron's article on marine governors "was violently attacked and the author derided." Now, that is not the fact, as "Excelsior," had he taken the pains to look at his file of MARINE ENGINEERS, would have seen. The article on governors was, as far as my judgment goes, a good one, and was spoken very highly of by at least two, if not more, correspondents. The grand "attack" was made on a paper on crank-shafts, in which Mr. T. G. Barron plainly argued that all those accidents, of every-day occurrence to shafts, were solely due to carelessness on the part of the engineers. This, coming from one of ourselves, was evidently so unfair and uncalled for, that the writer sent a reply, which, I believe, is the attack "Excelsior" has mixed up with the governor article. I've seen an engineer that took the thrust

for a sort of governing brake, but I think crank-shafts and governors are somewhat different to each other. That letter was written in November, but from want of room, I suppose, did not appear till March. "Governors" were reviewed in the February number, mark that down, will you, Mr. E., and read the article on crank-shafts.

Richard A. James Cope has my entire sympathy, but he will not mind being shouted at. "Lame below the hat." I think "Excelsior" might be a little more guarded, although, perhaps, he is far enough from Sas-les-Ostend. Ah! Well! *Chacun à son mauvais goût.* That sounds like "London Journal" French. I wonder where it did come from. I understand a wee French, and that is the first time I've seen the proverb rendered that way. For uneducated engineers the meaning is—"Every one to his (bad) taste." Why bad taste? Is it not bad taste to call another "ignorant as a charity boy," "lame below the hat," etc.

In conclusion, I may say that the reply to the article on crank-shafts was the first letter calling attention to our position, which has resulted in two-and-a-half years' correspondence, and now in the fruit earnestly desired by the writer years ago, viz.:—A union of seagoing men. "Excelsior," good-bye.

Thanking you, Mr. Editor, in anticipation, for inserting this,

I remain, Yours,

CHIEF ENGINEER.

To the Editor of The Marine Engineer.

Sir,—In your last issue there appears a communication from Sunderland signed "S," commending the letter of the "Engineer of a Mail Ship," and generally endorsing his views. It would not have been necessary for me to refer to that communication had it not been that its author, through mistaking the meaning of part of the letter of "E. M. S.," has written so as to convey the impression that the Marine Engineer's Union has been formed for the purpose of organizing strikes and other coercive measures. This erroneous impression being calculated to injure the Union by preventing many engineers from joining it who would otherwise do so, I feel called upon to state that the Union does not approve of strikes, but proposes to attain its objects by more reasonable and effectual means. "S" will perhaps more readily perceive this if he refers to one of my former letters, wherein it is mentioned that "E.M.S." has become a member of the Union, which he would not have joined had it not been in accord with the views expressed by him in his letter. I trust your correspondent will pardon me for pointing out his mistake for the reasons above named, and, as he expresses a desire to aid in building up such an institution as "E.M.S." describes, if he will kindly communicate with me I will have much pleasure in informing him how he may best carry out his good intentions.

Your other correspondent, Mr. Taplin, writes very warmly on behalf of deck officers. His lines have apparently fallen in very pleasant places if he has not, during the 13 years he says he has been at sea, had any of those disagreeable experiences that usually fall to the lot of others, and we must therefore attribute to the harmonious relations that have subsisted for so many years between him and his shipmates, the chivalrous zeal he displays in championing the cause of his friends when he imagines they are attacked, although, perhaps, some may think he might have reserved some of this zeal to be used on behalf of his own profession. He rebukes me for a want of charity in my comments upon the letter of "Veritas," who wrote anent "Deck Ornaments," but as the rebuke is perhaps bestowed more by way of caution to me in my official capacity than of direct censure, I accept it in a friendly spirit, and respect it accordingly.

"Speak of a man as you find him" is a good old maxim, and a very safe rule of conduct even in modern days, and as Mr. Taplin has acted up to it, he cannot in justice deny me the right to do the same. I frankly admit that during my own seagoing career I found many friends among shipmasters and navigating officers, but these friends were men who practised the golden rule, and who did not assume offensive airs of superiority towards those officers whose daily duties entailed the wearing of greasy serge, and the frequent application of a sweat rag to their begrimed and perspiring countenances. But I have also had ample experience of the vagaries of the other kind of deck officers who, as your correspondent very shrewdly guesses, have oftener than once tried to "sit upon" me, and I have still a very lively remembrance of these occasions. Charity is held to be the greatest of the virtues, and its exercise is no doubt to be commended, but I must remind Mr. Taplin that there is good authority for saying that *it ought to begin at home,* and while so many members of our profession are made the subjects of vexatious and often groundless charges by members of the other profession, I consider I am justified in taking up the cudgels on behalf of my brethren, and I intend to do so whenever the occasion demands it, even at the risk of being charged with uncharitableness. It goes without saying that there are good and bad in all professions, and no man in his senses, nor even an honorary chief secretary while suffering from an attack of "Deckomania" (if I may coin a word) would dream of blaming a whole profession for the misdeeds of a few of its members, and when I state that my remarks were levelled solely at these latter gentry, yclept "Deck Ornaments," I believe I have said enough to exonerate me from the charge of slandering an honourable profession, in which I number many friends, when I ventured to condemn the caddish conduct of a certain section of its membership.

Your correspondent has kindly quoted, for my especial benefit I presume, the words of a petition with which you and I, sir, probably became familiar when we were good little boys attending church and Sunday school with praiseworthy regularity; and as it is not meet that such considerate kindness should go unrewarded, I will, with your permission, commend to the notice of Mr. Taplin a very excellent moral precept, which runs thus:—"Thou shalt not bear false witness against thy neighbour." I wonder whether he has ever heard of a shipmaster accounting to his owner for an unusually protracted voyage by declaring that it was all the fault of the engines, while the counter showed by the revolutions registered that the vessel had steamed perhaps 300 miles more than the measured distance from port to port. If he is really ignorant of the existence of such a practice, and desires to know whether such things be, he may learn something regarding it by enquiring of the first chief engineer he meets ashore, and should he then find it is really prevalent, that knowledge will furnish him with a good clue to one of the reasons why marine engineers should desire to qualify in navigation. I am very glad to be able to ally his fears that he may some day be called upon to look after the tallying and stowing of cargo, by informing him that it is already the practice in many shipping companies to have the tallying done by clerks from their offices, and that the stowing and discharging is entrusted to petty contractors, whom I have heard named "stevedores." I am afraid I cannot hold out much hope of escape from the watch on the bridge he so much dreads, but even in the prospect of such a contingency there may be a gleam of hope, as there will be at least two officers on watch, and should he be senior officer he would have his choice between the engine room and the bridge. I would not advise any engineer to trouble about learning navigation until he had acquired a sufficient knowledge of his own profession to enable him to discharge efficiently the duties of chief engineer, but as I would like to see, some day not far off, the name of Mr. Taplin in the list of engineers who have passed in navigation, it may encourage him in that direction by mentioning that in conversation a short time ago with a very successful teacher of navigation, who is himself well up in steam, he assured me that an engineer who had passed a creditable examination in gaining his first-class certificate, would have no difficulty in acquiring within a few weeks a sufficient knowledge of navigation to enable him to pass for master, and that is all that would be required. These lines are written on board the s.s. *Gannet,* while returning from the formal opening of branches of the Union in Antwerp and Hamburg, and it would have done good to some of our easy-going, apathetic brethren nearer home to have witnessed the enthusiasm that attended the proceedings in both places. They have already a considerable number of members, which is daily increasing: there is a comfortable club room in each seaport; and the executive having been fortunate in securing as Honorary Secretaries for the respective branches men who are well known and much respected by their brother engineers, alike for their personal character and active business habits these two young branches from the parent stem present the pleasing prospect of a bright and prosperous future.

Thanking you again for your kindness,

I remain, yours, &c.,

THE HONORARY CHIEF SECRETARY,

Marine Engineers' Union.

S.S. Gannet, *July 20th,* 1887.

ZINC IN BOILERS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your issue of February last a letter appeared headed "Zinc in Boilers," and signed Henry Prior, who, in answer to "Engineer's" enquiry, and to the astonishment of very many of your readers, proclaimed—*I am the inventor*, and that he had in preparation a "statement for publication showing how it was brought about, and the quantities necessary for its management."

This extraordinary announcement to the marine engineering world appears to have been fulfilled in your June issue only in point, in the shape of a "brief *resumé*," from your able pen, "of this most interesting document." I cannot help expressing my regret that you did not give the contents of that document *in extenso*, as I feel sure that it would have afforded your readers some amusement, if nothing else, to have had an unvarnished history of—as your correspondent would say—*my* experiments and *my* experience with *my* boilers.

Were your correspondent known, even to those in the splendid service to which he belongs, as a man that had, during his long experience, either through perseverance or ingenuity, or both, done any good for his employers in the matter of prolonging the lives, if only of those boilers under his immediate charge, anterior to the present boilers, he would have been entitled, not only to respect, but also praise from all interested in so important a matter to shipowners and engineers. And, besides, he would have been entitled to something different to a brief repudiation of his statements from the pen of the writer.

The facts respecting your correspondent and *his* boilers, Mr. Editor, stands thus:—The powerful ship referred to by him was built in 1869, re-engined and re-boilered in 1877, or about *ten* years later than the date given; so that it will be seen that he only managed to keep them going—with much trouble latterly—for something over seven years only (due, possibly, to his experimental proclivities). The "amusing incident" which your correspondent refers to as having occurred in some of this vessel's new boilers (two) fitted with zinc by an "unfortunate patentee," enough was said at the time (end of 1877), and it will suffice to say that your correspondent, as the man in charge of those boilers, should blush at the very thought of the treatment they received at his hands—whether intentionally or unintentionally, it is difficult to say—in respect to the feed supply, and, consequently, the extraordinary difference in the density of the water in them on arrival in London. If there was anything "amusing" in connection with this business, that was the chemical test to which the water was subjected, and the satisfactory way (to themselves) the whole difficulty was solved by the experimentalists. Moreover, this is the first time that I and others, acquainted with the whole affair, ever heard that one of the boilers was fitted with zinc at the resident engineer's risk, and the remaining five at the author's own risk; while he tells your readers in the same paragraph that the plan of the "unfortunate patentee was nothing more or less than the author's own invention," which took him "over 17 years" to perfect, the invention being "an equal distribution of zinc hung in (by) wires, and put in boxes below the water line in the boiler," to intercept or "throw down," "the particles of brass that pass into the boilers" (an old and exploded idea)—metallic contact being "bosh"—which shows him to be the very reverse of conversant with Sir Humphry's teaching.

The writer, be it understood, had the privilege of inspecting the boilers of this vessel on arrival in London after each voyage, until she was lost, without a syllable from this would-be inventor, or any of the Company's engineering officers, of any other experiments going on in the other boilers.

Now, Mr. Editor, I trust you will pardon me if, in conclusion, I point out to you how thoroughly the question of "Zinc in Boilers" has been thrashed in the columns of your contemporaries "The Engineer" and "Engineering" during the last 10 years; and more important still is the immense good that has been done during those years both in Her Majesty's Navy and Mercantile Marine through the use of zinc in metallic contact as equally distributed as possible in the boilers. We have it on record that in the Mercantile Marine boilers were running with but a trifling reduction of pressure in them a short while ago nearly 15 years old, although they were 7 and 8 years old when the zinc was applied on the plan of the "unfortunate patentee," who is well known to

Your obedient servant,

"BATTERY."

27th June, 1887.

CERTIFICATED ENGINEERS IN STEAM YACHTS.

To the Editor of THE MARINE ENGINEER.

SIR,—Will the gentleman who signs himself the "Yacht Engineer," in your valuable journal, kindly inform me and the merchant service sea-going engineers, what he means by the following contained in his letter of last month's journal.

The "Yacht Engineer" says:—"For in several instances that have come under my notice time lying up in harbour and cruising around the British coast, has been refused, and in one case time actually spent going from port to port was only allowed." Whatever is the meaning of such a sentence is beyond my understanding. Mark you, first he says cruising around the British coast has been refused, and immediately after asserts that time actually spent going from port to port was only allowed. What is cruising around the British coast but going from port to port. In my letter published by you recently, I never said one word about yachts lying up. Any one would know a yacht lying up is not going to sea; how in creation could a yacht driver count that time (perhaps they do squeeze a little of such time in). What I did say is this, that two-thirds of the time a steam pleasure yacht is in commission is spent in harbour, and I defy contradiction; and in conclusion I may say that we engineers consider it a very great injustice that the Board of Trade allows such men as engine drivers to obtain at their hands engineer certificates of competency. The reason I say we engineers is, the honorary secretary Marine Engineers' Union is going to petition the Board of Trade to allow only mechanics to appear before them. Why should the Board of Trade in any way acknowledge sea service on board a steam pleasure yacht? The Board, or rather the law, does not require them to carry certificate officers of any grade.

Thanking you for your kindness, I remain, yours truly,

W. F. O.

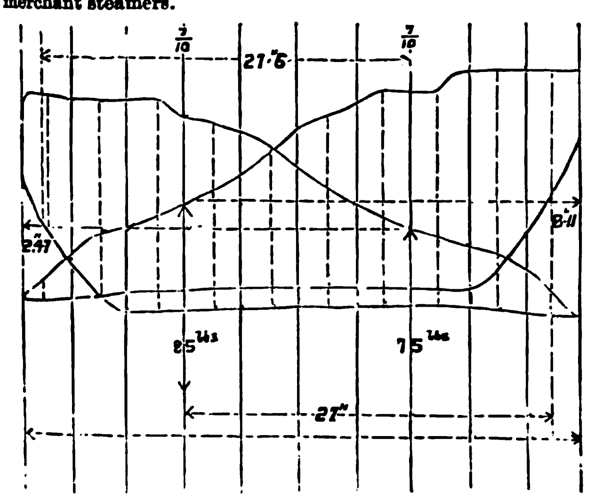
TRIPLE-EXPANSION ENGINES.

To the Editor of THE MARINE ENGINEER.

SIR,—It was not till my arrival at Suez to-day, that I had the privilege of seeing your April number, and the response which my former letter to you has elicited from Mr. Cole. I shall be glad to oblige him, but, before acceding to his request, I wish to rectify an omission in my last letter, which may have caused some misunderstanding. To have conveyed my meaning correctly, I should have added "for comparison" to the words "This amount is, I think, quite sufficient." I simply used one inch as the unit of clearance, as a convenient one for calculation, and to be on the safe side with such small scale diagrams, when comparing the results shown on the paper with others which had come under my own observation. As a matter of fact, I think that the clearance space may be omitted when calculating the weight of steam shown on the diagrams, as this space in all quiet running engines is usually filled with steam, which has been retained in the cylinder, and compressed by the piston to a greater pressure than obtains in the cylinder at $\frac{1}{10}$ of the stroke, and I have little doubt that if the weight of steam be calculated from the original diagrams, and a correct factor of evaporation duly allowed for in each case, that the results would be *less* than I have already made them appear in the table. I enclose a set of triple-compound diagrams taken from the engines of a steamer during her last outward voyage to Bombay, and the engineer informed me that they fairly represent the ordinary work of the engines throughout the voyage. I also enclose the calculations, with notes, and if you will kindly insert a sketch of the H.P. diagram, with its accompanying figures, I think it will be sufficiently illustrative to meet the wishes of your correspondent. The intermediate and low pressure diagrams may be omitted, as they are irrelevant to the issue. In the table I followed the method adopted by Professor Kennedy in adding 15 per cent. of the weight of steam shown on the cards for initial condensation, but this, as Mr. Morrison shows, is different from assuming that the cards only show 85 per cent. of the steam used. In the enclosed example I have assumed the latter to be the case. I find that the aggregate power developed in the three cylinders is 995, and the weight of steam used per I.H.P. per hour is 15·8 lbs. I have never had charge of a triple-engine, and I am therefore unable to state whether 15·8 lbs. of water per I.H.P. is a result representative of the type, but a somewhat extended experience of diagrams taken from ordinary compound engines, working at 80 lbs. and upwards, leads me to infer that when 15 per cent. is added for initial condensation, an

engine in fair working order should not show more than 20 lbs. per I.H.P. But as I am unable to send the results of my own experience, I will cite some of the published statements made by others, and I invite your correspondent to compare the conclusions which follow from the professor's premises (when a correct factor of evaporation is used) with the results published in your May number of last year, referring to some experiments carried out with a return tube boiler in Philadelphia about twenty years ago, which appears to show that 13·6 lbs. of water, can be evaporated per pound of coal. Again, D. K. Clark's work on fuel, &c., contains the result of some experiments carried out with a marine boiler at Newcastle-on-Tyne, from which it was found that a pound of North-country coal, could be made to evaporate 12·91 lbs. of water, from and at 212° Fah., with natural draught. More recently Mr. Kirk has stated that the engines of the s.s. *Aberdeen* only consumed 1·28 lbs. of coal per unit of power, which I think represents a high evaporative duty if the indicator diagrams were manipulated in the manner adopted by Professor Kennedy, and the condensation which took place in the steam jackets was included in the result. With regard to forced draught I beg to direct attention to THE MARINE ENGINEER for June, 1886, which contains Messrs. Scrutton's report of the performance of their steamer *New York City*. The writer of that report is responsible for the statement that an ordinary compound engine has been worked throughout a long voyage on an average consumption of 1·337 lbs. of coal per I.H.P. At the moderate computation of 18 lbs. of water per I.H.P., this represents an evaporative duty of 13·4 lbs. from and at 212°. In the face of the foregoing, I think I was justified in assuming that anything between 10·4 and 12·5 was possible (though not probable under ordinary circumstances), even if I was without corroborative evidence furnished by my own experience. I offer no opinion as to the amount of condensation which takes place in the cylinder. I only wish to state, that if Professor Kennedy's estimate of it is correct, that I think none of the examples contained in the late Mr. Wyllie's paper as published in THE MARINE ENGINEER are impossible, unless one studies it with a microscopic eye for the purpose of finding defects, which I suppose may be often discoverable when the illustrations are so much reduced in scale. I inferred that the *Lusitania's* consumption was reduced in ratio, as 52 : 37 : : 2·08 : 1·48, as 52 and 37 was specific figures, while 50 was only approximate, and I don't think the author meant to commit himself to the statement that the engines used less fuel per unit of power at full, than at moderate speeds.

Before concluding, I wish to call attention to the fact that in every instance where I have seen published comparisons between the results obtained from ordinary and triple-compound engines, it has been between new engines and boilers of the latter, compared with old engines and boilers of the former type. This is obviously unfair, and gives an undue advantage to the triple engine, whose superiority has made itself sufficiently apparent without exaggerating it, by quoting upwards of 2 lbs. of coal per unit of power, as representative results of ordinary compound practice in merchant steamers.



Mean Pressure of card 59·41
" " top 57·96 lbs.
" " bottom 60·87 lbs.
Absolute Pressure $\frac{7}{10}$ from top 75 + 15 = 90 lbs.
" " " bottom 85 + 15 = 100 lbs.
Stroke, 42 in. Revolutions, 61.

$24^2 \times 7854 = 452{\cdot}39$ square inches area of H.P. cylinder.

$\frac{452{\cdot}39 \times 60 \times 61}{1728} \times 27'' = 25871{\cdot}049$ cubic feet displaced per hour by bottom side of piston, assuming the stroke to be 27", and the revolutions 61 per minute.

One cubic foot of steam at 100 lbs. absolute pressure weighs 0·233 lbs.

$\therefore 25871{\cdot}049 \times 0{\cdot}233 = 6027{\cdot}954$ lbs. steam up stroke.

$\frac{452{\cdot}39 \times 60 \times 61}{1728} \times 27{\cdot}6'' = 26445{\cdot}9612$ cubic feet displaced per hour by top side of piston, assuming the stroke to be 27·6", and the revolutions 61 per minute.

One cubic foot of steam at 90 lbs. absolute weighs 0·212 lbs. very nearly.

$\therefore 26445{\cdot}9612 \times 0{\cdot}212 = 5606{\cdot}543$ lbs. steam down stroke.

And $\frac{6027{\cdot}954 + 5606{\cdot}543}{995} = 11{\cdot}7$ lbs. weight of steam shown on card per I.H.P. per hour.

$11{\cdot}7 \times 1{\cdot}15 = 13{\cdot}45$ lbs. from and at 212 Fah.

$\frac{13{\cdot}45 \times 100}{85} = 15{\cdot}8$ lbs. including the 15 % lost by initial condensation.

I am, Sir, yours truly,
J. WILLIAMS.

SUEZ CANAL,
May 14*th*, 1887.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from June 9th to July 14th, 1887.

8328 J. H. Morgan. Dredging and excavating grabs.
8331 G. Spencer. Steam pressure reducing valves.
8339 J. T. Collinge. Rotary pumps, &c.
8348 A. Smith. Slide valves for engines.
8351 A. Jones. Life, &c., saving apparatus.
8355 G. S. Picking & W. Hopkins. Direct-acting steam and other pumps.
8362 G. Hartshorne & G. F. Simms. Anchors.
8393 G. Eskholme & O. E. Chrimes. Relief valves.
8396 A. J. Marquand. Preventing corrosion, &c., in steam boilers.
8401 Brombead (C. Sonnet & A. Leredde). Permanent log or speed meter for ships.
8411 J. C. Tanner & J. Mansbridge. Torpedo conductor (submarine).
8412 H. P. Golton. Sculls, oars, &c.
8413 G. H. Stechmann. Feeds and feed water heating apparatus for steam boilers.
8440 McMullen (J. A. McMullen). Firing torpedoes or submarine mines.
8446 H. E. Daniell. Receiving with less friction the thrust of marine engine screw shaft.
8447 P. G. B. Westmacott. Shipping and transferring coal.
8480 T. Drewry. Cleansing ships' bottoms.
8487 G. H. Hayler. Lowering boats from ships' sides.
8519 J. Sample. Life-saving buoy boats.
8526 J. Bosch. Steam ship propulsion.
8533 O. E. Pohl. Propelling steamers.
8534 J. Morrin. Packing for stuffing boxes.
8536 A. H. Simpson. Operating and controlling torpedoes.
8542 T. Villiard. Locks for canals, docks, &c.
8578 J. Landells. Rotary engines, &c.
8582 H. Postans. Rotary expansion steam engine.
8605 E. Lightowler. Protecting sea beaches.
8607 J. Manson. Ship's hatch tarpaulins.
8609 D. Ashton. Propelling and steering boats.
8615 J. G. Scott. Steamers, &c.
8625 J. Bosch. Submarine wheel for steam ships, &c.
8640 E. J. Ayling. Button or stop for oars, sculls, &c.
8658 W. H. Mirfin. Internal furnaces and flues of boilers.

8659 H. P. Fenby. Marine and other engines.
8661 M. Goldstein & L. Levy. Boat.
8669 J. Clayton. Coverings for ships' boats.
8670 W. J. Ellis. Centrifugal pumps.
8702 E. Wortmann. Rotary engines.
8714 W. J. Reynolds. Mariners' liquid compasses.
8737 J. W. Willans & J. B. McCulloch. Motor for steam, water, &c.
8740 W. Cooper & J. Holdsworth. Shipping coal.
8770 A. H. Carpenter. Feathering blade wheels.
8771 J. Reid. Pulsometers.
8799 A. H. Williams & E. L. White. Conveying boats over weirs and rapids.
8801 R. G. Brooke & T. White. Condensers.
8808 E. Hafner. Safety valve.
8821 J. Hemington. Pumps.
8840 J. J. Arnold. Armour plating.
8844 A. A. Rickaby. Shipping coal.
8883 J. Lewis. Valves.
8884 J. Lewis. Rotating or oscillating valves.
8891 W. S. Price. Propelling ships.
8894 J. I. & T. Cox. Anchors.
8896 T. Ray. Anchor.
8938 G. Donkin, B. G. Nichol & H. Macarthy. Feed water heater and circulator.
8945 S. Smillie. Producing fresh water from sea water.
8946 H. Fletcher. Capstans.
9007 T. Paton. Steering gear of boats.
9056 Thompson (J. Olof). Pumps.
9057 M. Blair. Recording distances run by steamers, &c.
9059 E. A. Wade & J. Langdon. Rotary engine.
9066 J. F. Hall & J. Verity. Boilers.
9098 S. Elston & A. Harrison. Circulating plates for steam boilers.
9121 P. Oriolle. Steam boilers.
9128 G. E. Dow. Engine governors.
9142 W. Wright. Marine propulsion.
9171 F. H. Snyder. Propellers for ships.
9197 Boult (E. J. Blood). Cannon.
9236 J. Griffiths & J. M. Anthony. Equilibrium slide valve.
9241 T. Knudson. Ships' davits.
9261 C. A. Petterson. Disengaging ships' boats.
9271 J. Harrison. Regulating the speed of steam engines.
9276 J. Fletcher. Injectors.
9336 R. Brough. Automatically closing valves.
9394 G. Robson. Piston springs for steam engines, &c.
9412 E. E. Clark. Pumping engine.
9418 S. S. Younghusband. Valve gear of steam engines.
9427 Christie, Gledhill & Carington (J. B. G. A. Canet). Gun carriages and mountings.
9441 L. McIntyre. Heating feed water for boilers.
9456 J. Willoughby & A. Gledhill. Smoke consuming apparatus for boilers.
9501 Thompson (The Aërated Fuel Co). Steam generator and furnace.
9528 Haddan (J. Rademacher & F. Voss). Link motion of steam engines.
9532 W. R. Bigsby-Chamberlin. Propulsion, guidance, and stoppage of ships.
9537 R. Hamilton & T. McKillop. Promoting combustion in boiler and other furnaces.
9546 J. Atkinson. Blast pipe and exhaust arrangement for steam engines.
9555 G. Quick. Ordnance.
9574 J. Hull. Steam boiler and other furnaces.
9609 D. Greig & F. J. Anson. Automatic governing of compound engines.
9613 C. Skidmore. Closing watertight doors in ships.
9619 J. Reid. Tube stopper.
9638 W. & J. Beesley. Steam boilers.
9641 P. Berthelot. Preventing ships from sinking and raising them if sunk.
9645 F. Martenot. Steam and other boilers.
9647 A. Glembowieski. Rotary motive-power engines.
9649 Menzies (J. Menzies). Stern bearings of screw-propeller shafts.
9656 Gedge (Weidenbrück & Wilms). Fire bar.
9675 Boult (P. Aunay). Packing for stuffing boxes.
9686 Christie, Gledhill & Carington (J. B. G. A. Canet). Gun carriages.
9687 Christie, Gledhill & Carington (J. B. G. A. Canet). Gun carriages.
9688 Christie, Gledhill & Carington (J. B. G. A. Canet). Hydraulic brake apparatus for ordnance.
9689 T. Nordenfelt. Automatic machine gun.
9691 J. & H. S. Batson & W. G. Causer. Charging steam boilers without anti-corrosive liquids.
9702 W. Chilton. High pressure steam engines.
9718 Stevenson (A. Poidlovë). Water gauge glass reflector-indicator.
9719 R. Creuzbaur. Steam engines.
9721 Thompson (R. A. Cron Schlieben). Propelling vessels.
9723 T. Mudd. Steam engines.
9759 W. Preston. Water tap or steam valve.
9768 J. Hewitson. Preventing boiler explosions.
9797 T. Kirkwood. Furnace grates.
9804 Boult (F. Cuervas-Mons). Protecting ships' hulls.
9827 W. P. Hoskins. Ships' berths.
9854 F. R. Cedervale. Lubricating and protecting screw propeller shafts.
9860 E. J. Preston. Pumps.
9882 W. S. Bancroft & J. Horsfall. Steam engine valve gear.
9893 S. H. James. Steam engines.
9902 Wilding (C. J. Boye). Oil distributors.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

July 16th. Jones, Arthur L. Extra 1 C Leith.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

June 25th, 1887.

Arnott, Robert ..	1C	Glasgow
Cape, James	2C	Liverpool
Collings, E. W..	2C	,,
Durey, John	2C	Sunderl'd
Embleton, Wm..	2C	,,
Gardner, Alex. A.	2C	Liverpool
Kershaw, Jos. J.	2C	,,
Logan, Wm.....	2C	Sunderl'd
Mills, Thos. Park	1C	Liverpool
Pearse, Reginald.	1C	,,
Peat, James	1C	,,
Simpson, W. T..	1C	,,
Stuart, Thos. M.	1C	Sunderl'd
Thornber, Wm. A.	2C	Liverpool
Toft, Ernest H..	2C	Sunderl'd
Walker, Thomas.	2C	Liverpool
Weston, John ..	1C	Sunderl'd

July 2nd, 1887.

Carampateas, D..	2C	Liverpool
Emery, Robt.....	1C	Glasgow
Holliday, Wm....	1C	N.Shields
Hunter, John C..	2C	London
Little, Joseph W.	2C	Liverpool
Mackay, Samuel.	1C	London
McLean, John ..	2C	Liverpool
Pearson, Chas. O.	2C	N.Shields
Pullin, J. F. P...	1C	London
Quinn, M. N....	2C	Liverpool
Rogers, Henry ..	2C	Bristol
Silvester, Jas. S..	2C	Hull
Spenceley, G. E..	2C	,,
Taylor, Chas. W.	2C	Aberdeen
Watson, Benj. F.	1C	London

July 9th, 1887.

Allan, Nathaniel.	1C	Glasgow
Bradley, Jos. T..	2C	Leith
Butler, James C.	1C	,,
Darke, Clifford ..	1C	London
Findlay, David..	2C	Leith
Gavin, James ..	1C	Glasgow
Gordon, David ..	1C	,,
Gray, Alex.	1C	,,
Harper, Chas. W.	1C	Leith
Heggie, David ..	1C	Belfast
Keay, James	2C	Leith
Kempt, Alex....	2C	Glasgow
Leishman, David	1C	Leith
Mathieson, Dan.	2C	Glasgow
McDermaid, Alex.	1C	,,
McKendrik, C. D.	2C	,,
Muir, John......	1C	,,
Murdoch, R. A..	2C	Leith
Murdoch, Wm...	1C	Glasgow
Murray, Chas. ..	2C	,,
Ostler, James C.	1C	Leith
Pritchard, E.....	1C	Liverpool
Ramage, James..	1C	Glasgow
Ritchie, Richard.	2C	,,
Wilkie, James ..	2C	,,

July 16th, 1887.

Allen, Alfred Geo.	2C	London
Arnold, Edwd. T.	1C	Glasgow
Black, James....	1C	Hull
Brown, Robt. S..	2C	Dundee
Campbell, David.	1C	Glasgow
Colquhoun, Arch.	1C	,,
Douglas, John ..	1C	,,
Evans, William ..	2C	Liverpool
Farrow, Albert..	1C	Hull
Fishwick, Arthur	2C	N.Shields
Flett, Robt.	1C	Glasgow
Forster, Thos. E.	2C	N.Shields
Gard, John James	2C	London
Howe, John Geo.	1C	N.Shields
Lowe, Hy.......	1C	London
McIntyre, A. J..	2C	Glasgow
Mitchell, George.	1C	Dundee
Morton, Thos. T.	2C	Glasgow
Muir, Chas.	1C	Greenock
Neil, James	1C	Glasgow
Purchase, A. E..	2C	London
Robertshaw, F..	2C	Hull
Rutherford, Jas..	2C	Glasgow
Short, William ..	1C	Liverpool
Sinclair, Arch...	1C	Glasgow
Stevenson, Jas...	1C	,,
Ward, Thomas ..	1C	London
Williams, John F.	2C	Liverpool

The Marine Engineer.

LONDON, SEPTEMBER 1, 1887.

EDITORIAL NOTES.

FOR the last eight to ten years basic steel, produced by the Thomas Gilchrist process, has been steadily struggling to the fore, as a material which shall prove equally reliable, strong and workable as the Siemens mild steel, which now holds so honourable a position as a valuable material in steel ship-building. The value to this country of the successful production of basic steel of equal quality with the Siemens steel will prove enormous, as the Cleveland ironstone and the Scotch ores will thus become as applicable to the production of the best mild steel as the scarce and higherpriced haematite ore, or other oxides to which the Siemens and Bessemer acid steel processes are limited. The cause of this arises from the fact that the larger proportion of Cleveland, and English and Scotch ores have a considerable percentage of phosphrus in their composition, even as much as two to three per cent. The acid steel processes, so called from the acid nature of the linings used, and the consequent acid character of the slag, do not effectively touch or remove this phosphorus, and the smallest percentage of phosphorous remaining in the steel ingots makes them rotten and brittle to work. Thus, under the acid processes, England is largely dependent upon imported haematite ores, and the small quantity available keeps up the price of the best mild steel. We have been much interested in the rapid development of the basic process, having had the pleasure of a personal acquaintance with one of the gifted inventors, Mr. Thomas, whose early death, just as he saw the first fruition of his labours, cast a lamentable gloom over the history of one of the most important revolutions in the iron and steel industries, not only of England, but of the Continent, where the process early took root and flourished. The progress of the basic process, like all other inventions, has been subjected to great vicissitudes, and so late as 1885 it came into unenviable notoriety in the ship-building trade on the North East Coast, as responsible for the production of a quantity of brittle and unreliable steel, which had to be condemned by Lloyd's surveyors as unsuitable for ship-building, and which caused the general condemnation for the time being of the material altogether for ship-building. Many firms even gave up its production altogether. Similar trouble was encountered by the German made basic steel when applied to ship-building there, though it had already obtained a large market for inferior purposes. Messrs. Bolckow, Vaughan & Co., The Butterley Company, The North Eastern Steel Company, The Staffordshire Steel & Iron Company, The Glasgow Iron Company, The Brymbo Steel and Iron Company, still, however, persisted in more careful treatment of the ores, and further experiments towards the production of greater homogenity and reliability, and we are glad to compliment these and other firms in the very successful results they seem now to have attained, as evidenced by two very interesting papers read before the Institution of Naval Architects by Messrs. W. H. White and B. Martell. The latter gives a most interesting sketch of the struggles and progress of the basic process, with a very clear statement as to the nature of the process as compared with the acid process. The basic process owes its name to the nature of the lining, which is made preferably of magnesium limestone which is essentially "basic," instead of the acid silicious firebrick or lining used in the Siemens and Bessemer acid process. The basic lining, with a basic charge of well-burnt lime, absorbs the phosphorus entirely, producing a slag rich in phosphate of lime, and which has proved, when ground, a useful manure. Mr. Martell, whilst carefully pointing out the unsatisfactory nature of the metal as at first produced, which caused Lloyd's Committee to entirely refuse to accept or pass the material at all in shipbuilding, reports that at last since 1887 the Glasgow Iron Company have entirely satisfied Lloyd's surveyors that a mild steel up to half an inch in thickness can be produced which satisfies all their test requirements. As the test experiments have as yet not extended beyond this thickness, Mr. Martell carefully reserves his opinion as to scantlings beyond this dimension. Mr. White's reports of tests on behalf of the Admiralty have been applied to material taken from ordinary contracts under delivery at the works of at least half a dozen firms, including those mentioned above, and have extended over all sorts of materials up to one inch in thickness. Carefully tabulated tables of all sorts of tests, with the results in tensile strength and durability, are given in Mr. White's paper, showing that the tests, as he states, have been as exhaustive as upon the first introduction of Siemens' mild steel for construction in our navy. Taken generally, the results are most satisfactory and uniform from the material supplied by all the firms in question, thus showing that the results may be generally relied on as commercial rather than experimental facts. Under some circumstances, such, for instance, as annealing, the

strength of the basic steel is not so much affected as in acid steel, and, in fact, in several instances annealing increased the tensile strength of the basic steel. At a "blue heat" also the basic steel seems to have qualities almost superior to the acid steel. The result of these satisfactory tests has been that small test orders have already been given in the Government dockyards, which have so far turned out well, so that it looks now as if basic steel were well through its troubled waters, and about to take a most prominent position amongst the best mild steels for shipbuilding.

THE early part of this month witnessed one of the most striking British naval reviews of modern times. However critics of the day may run down England's Navy the sight of the noble line of ironclads and cruisers off Portsmouth made so grand a show that it was, at least, hard to believe all the derogatory things that are said about their fighting power and general efficiency. The review was, however, followed by a series of naval manœuvres spread over both the British and St. George's Channels, and which, by the varied nature of their operations, and the great extent of coast over which they were spread, showed very conclusively the magnitude of a Navy consisting both of sea-going ironclad and home defence vessels and torpedo-boats, which would suffice to carry out the rôles of both attackers and defenders over so large an area. The operations have, unfortunately, had a comical and absurd side to them, which must needs follow where neither side has the potentiality for destruction, and where, at the same time, neither side is disposed to consider itself beaten with the proverbial obstinacy of Englishmen. This ludicrous side of the operations was at times so prominent that the manœuvres have been characterized by high authorities as "tom-foolery." We feel sure, however, that much experience has been gained at any rate in the best disguises for night surprises, or in the best means for patrolling and guarding the coast. The admirals and officers must have also learnt much as to the relative fitness of different vessels in the various squadrons for carrying out specific duties. The great diversity of type also in our various ironclads must also have received some considerable test as to their respective merits under circumstances of emergency. There was wanting, however, the very serious test of heavy weather, which would otherwise have proved of great value. A point that was brought out most forcibly was the importance, either to the attack or defence, of a ready accessibility to coal supply. The command of this by our home defences, to the exclusion of an invading navy, would make all the difference to their relative powers of offence and defence. It is obvious, however, that so many of our coast towns being defenceless and subject to surprise would have to be prepared to remove or destroy all coal stores to adequately preserve them from the requisitions of an invading navy. One point which was very noteworthy, was the heavy black smoke emitted from the funnels of the ironclads when running at speed. A cloud of smoke is an obvious indication of the course and presence of a war vessel long before it is in sight, or long after it is hull-down when receding. This would be most dangerous to an escaping vessel, or most grievous to an attacking force. If almost perfect consumption of smoke is now practically a necessity on land, and can be readily attained, surely the same can be effected on board ship. The breakdown of the *Collingwood* and *Inflexible* is a matter to be regretted, as the smallest disaster in machinery which might cause temporary disablement of such formidable warships might entirely alter the conditions and results of a naval engagement. As a whole, however, we are glad to find that the vessels, when subjected to the severe strains of dodging, pursuing, or escaping at high speed, stood the strain so well, and with so few casualties to their machinery. There will be much difference of opinion as to the success of the various operations of attack and defence, though there can be no doubt that great praise must be given to the dash, energy, and pluck displayed by all parties, which, had it been evinced by one side only, would probably have determined the victory in their favour. It is generally thought that the torpedo boats often came off badly in their exposure to the heavy fire of the ironclads, and that the attacking force were wonderfully expert and successful in eluding the defenders, and in their attack upon various coast towns and London.

WE are glad to see that the Marine Engineers' Union is flourishing, and promises to fulfil all the favourable prognostications that we ventured to endorse as to its career, and the useful purpose it might fulfil. We firmly believe that any want of social recognition of a useful class of men, such as sea-going engineers complain of, must arise in some degree from a want in themselves as a body, and possibly neglect on their part to raise themselves to the platform to which they might have a right to aspire. The mere fact of showing themselves sufficiently self-reliant, and self-supporting, to found and carry on such a Union as that to which we refer is, in itself, a considerable step in the right direction in

invitation of the many professional and scientific institutes of their professional brethren. Places of convenient resort, also in ports where they may chance to stay, and where they can obtain rational amusement, and the interchange of ideas and civilities with their brethren, will all work slowly but surely to greater self-respect as a class, therefore to greater claims to recognition and respect from others. We should be glad to see ardent efforts made by the engineers to associate on equal terms, and thus become hand in glove with their messmates of the other branch of the service, as mutual goodwill and hearty recognition can come only from mutual better acquaintance and respect, rather than from persistent demands for a status not freely accorded. What can better serve these ends than the possession and membership by the marine engineer of social clubs of good style, where hospitality can be gracefully accorded to their perhaps less fortunate fellow-officers of the other branch of the profession. We are glad to see that club-houses are already started in Antwerp, Cardiff, Hamburg, Liverpool, and Newport, whilst a house has been specially acquired by the Union in the East India Road for this purpose as the headquarters of the Poplar and Victoria branches. We shall not be satisfied until we hear that the Union has been able to acquire equally good and respectable premises for their branch club-houses, according to their expressed intentions. We should like to see the excellent programme of the Union carried out well, and in good style, now that it has been so well started, and each club-house an outward and visible sign of the inward self-respect of the numerous and important professional body that they are to represent. We see that the Executive Committee of the Union are also not restricting their attention merely to the outward symbols of high professional status, but have organized a scheme for the better classification of, and qualifications for, certificates of competency, which, it appears to us, will not only ensure better quality in the certificated engineer, but will prove a beneficial guarantee of practical competency to the shipowner. This is again hitting the right nail on the head. Let so-called engineers, from the lowest to highest, be practical engineers, who know the cylinder from the air-pump before they pretend to take charge of vessels' engines, and do not let greasers or mere labourers usurp, by their greater practical knowledge, positions and responsibilities which should be filled by junior engineers training for the higher berths. The essential improvements for test of competency proposed by the committee is for better guarantee of practical qualifications as a good workman before seeking to take charge, and that a candidate for a third-class certificate should have served on the articles for one year as assistant, much to his personal benefit and to that of the shipowner, who would thus eventually obtain an engineer for his money, and not what we might term a mere improver, who learns at the cost of his employer, and of his chiefs, when he should be taking his full share of work and responsibility. We wish the Union God-speed on these lines, and every success.

Lord Armstrong and J. Vavasseur, Esq., contributed to the Institute of Naval Architects a paper of considerable interest upon the application of hydraulic power to naval gunnery. This subject should be of essential interest to our professional readers of H.M. Service, as it forms so large a part of the fighting mechanism of the modern ironclad. The authors review the gradual displacement of the old wooden carriages by iron carriages supplied by hydraulic power to handle the enormous mass of the modern heavy guns. First, to deal with the heavy recoils the compressor brake was adopted, which, however, was eventually found inadequate to the service required from it, and was superseded by the hydraulic brake. From the adaptation of hydraulic power merely to the absorption of the recoil to the running in and out of the gun, it was then adapted to the loading, training, and elevating. The Vavasseur system was elaborated with a view to give a nearly regular recoil under all circumstances to provide an adequate elevation and training gear for the heaviest class of guns. Advantages claimed for the system are almost perfect muzzle pivoting, and, as a consequence, the port is almost filled by the chase of the gun; also, the recoil chamber is always parallel to the line of recoil of the gun, and even if the muzzle were shot off the elevating gear would not be disabled. The authors give a detailed description of the Vavasseur apparatus of great interest, and various particulars of many different types of hydraulic mountings as at present used.

Works are projected at the port of Ostend with a view to a new high-speed steamer service between that port and Dover.

Patent Slide Valve Gear.—During the past few days no less than three ships of the Royal Navy have been seriously disabled through the gearing for working the slide valves having broken down. H.M.S. *Narcissus*, while working some preliminary trials before proceeding from Hull to Portsmouth, carried away brackets and rods in connection with the slide gear: H.M.S. *Amphion*, during the recent Jubilee Review, had her Joy's valve gearing entirely disarranged: and H.M.S. *Galatea*, fitted with Kirk and Brock's patent gearing, had her forward engines completely disabled through the collapse of this part of her machinery. These disasters occurring on top of one another, will, it is expected, lead to the abandonment of fancy notions for slide valves, and a return to the well tried and never failing link motion.

SUMMER SESSION OF THE INSTITUTION OF NAVAL ARCHITECTS.

THE Summer Session of the Institution of Naval Architects was held, upon the invitation of the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle-upon-Tyne, on the 26th, 27th, 28th, and 29th of July.

That the meeting was a most successful and interesting one in every respect goes without the saying, for we question whether any other city in the kingdom could have brought forth such a gathering of local men of eminence as were banded together at Newcastle to take the lead in the task of making the meeting a thorough success in every sense of the word. It is due to Mr. J. Duckitt, the Secretary of the North-East Coast Institution, to say that the successful carrying out of the whole programme, as arranged by him, was in a great measure due to the courtesy and tack with which he carried out the whole of his arduous duties, and we are sure that the members of the Institution of Naval Architects are in every way satisfied with, and thankful for, the whole of the arrangements made.

The proceedings commenced on Tuesday morning by the official reception of the Institution, in the Lecture Hall of the Literary and Philosophical Society, by the President and Council of the North-East Coast Institution of Engineers and Shipbuilders, who were accompanied by the Mayor (Sir B. C. Browne), Sheriff (Alderman Stephenson), and Town Clerk (Mr. Hill Motum) of Newcastle.

Mr. Doxford, as President of the North-East Coast Institution, welcomed in most hearty and felicitous terms Lord Ravensworth and the Institution of Naval Architects to the north-east coast, and his sentiments were fully endorsed by Sir B. Browne, who, speaking as Mayor of Newcastle, extended in his official welcome the cordial greetings of the citizens of that ancient port. Following this ceremony, the Earl of Ravensworth took the chair, and the business proper of the meeting then commenced with the Presidential address.

PRESIDENT'S ADDRESS.

Lord RAVENSWORTH then took the chair, and said that he had first the pleasant duty to perform of thanking, on behalf of the institution with which he was connected, Mr. Doxford, the Mayor, and the other gentlemen, for their kind and cordial reception that morning. In doing that part of his duty, and in addressing a few observations with their permission on that interesting occasion, he would promise them that having a strong conviction of the value of their time he would avoid as much as possible unnecessary length in his speech. At the same time, he was in duty bound to remember his own position on that occasion, and it was rather a curious one. He could only liken it to that odd creature that naturalists had written a good deal about, called the chameleon, and which they told them had the power of changing its form and character to suit the circumstances under which it might find itself. He was there in a double capacity which he must adopt according to circumstances. He was there in the pleasing capacities of host and of guest, and as host he bade a most cordial welcome to the Institution of Naval Architects and Marine Engineers. He did his best to join in the hospitality for which he hoped their neighbourhood was celebrated; and he particularly wished to direct, as a host, attention to a certain Exhibition on the Town Moor, which had been the object of admiration to all who had seen it. It was not for him to praise it, but he would venture to quote a very high authority in reference to the Exhibition. His Royal Highness the Prince of Wales, who, greatly to his own satisfaction, and, he was sure, to the satisfaction of every person—man, woman, and child—in this town, visited the Exhibition the week before last. His Royal Highness said to him personally, in parting, "I have seen exhibitions for 36 years. You have displayed your arts, your manufactures, and your sciences, in the most complete and perfect manner, and I have never seen an exhibition that had so little of the bazaar about it as yours." He had nothing to add to these feeling, sensible, and pregnant words. But it was high praise, and he was sure that they would deem it so, because His Royal Highness was probably more experienced than any other living man in respect to exhibitions all over the world. As host he had endeavoured to discharge his duties to the Institute, but now he came to a still more gratifying position which he held—viz., that of their guest—because he appeared there with the institute who were about to receive, as they knew they would receive, the kindness and attention and the instructions of that excellent society of which they had heard from the mouth of its president. The Institution of Naval Architects stood towards the North-East Coast Institution of Shipbuilders and Engineers in the delightful relationship of parent to a child. He hoped no one would take offence at the word child. It had simply reference to the age of the institution, but the Institution of Naval Architects certainly claimed to be the parent institution, being the oldest. When he spoke of the North-East Coast Institution as a child it had only reference to its age, because it seemed to him almost to have sprung, like Minerva of old, into the full vigour of manhood, armed with science, experience, and knowledge at once, and had already in this short period of three years developed a highly vigorous and intelligent manhood. It was to the kindness of that institution that they owed their visit, which promised to be a success and certainly to afford very much instruction. There might be some captious critics who would say it was rather like bringing coals to Newcastle to bring down mechanics, engineers, and shipbuilders to the Tyne. He was sure no man in that room would join in such criticism as that, because, if he was not greatly mistaken, clever men, accomplished men, scientific men liked to meet each other anywhere. They liked to compare notes, to interchange ideas, to compare results of their experience, knowledge, and research, and they like to see, examine, and judge for themselves, of any invention, from whatever class of society that invention might proceed. These men were really the *raison d'être of* institutions of that kind, and he spoke on behalf of every member of the institution when he said it had given them the greatest possible satisfaction to meet in this great commercial centre of Newcastle. They were about to judge for themselves of the great commercial resources and wealth of the Tyne, and he hoped also of its increasing prosperity, because there was room for a considerable rise for this great commercial port and immensely wealthy commercial neighbourhood. They would have an opportunity of judging for themselves of the resources of these two great rivers—the Tyne and the Wear—and he would just like to mention one or two matters which he thought could not fail to be of immense interest to the institution with which he was connected. As the guests of the North-East Coast Institution of Engineers and Shipbuilders they would have an opportunity of seeing the great establishment at Elswick, which he did not believe had an equal in the world. It was the great northern arsenal of which they were all so proud, just as they were proud and gratified to see their excellent and worthy friend Lord Armstrong sitting amongst them to-day, and devoting a portion of his valuable time to their enlightenment and instruction. They would have an opportunity also of witnessing another great establishment, second to few, if any, in the kingdom, that was the great establishment at Jarrow, where he believed they boasted that in one year they built a larger amount of tonnage than any single establishment in this or any other kingdom. They built, he believed, no less than 62,000 tons of shipping in one year. It would be invidious for him to make any distinctions in regard to the various establishments on the Tyne and the Wear. He merely took these as specimens of what they could show. But they would see on both banks of the Tyne and upon the Wear establishments of immense magnitude conducted on the best possible commercial principles, and they would have to judge the value of these great establishments. There was one particular point he would like to mention. It was the hobby of his own, and he was not ashamed to confess it—he had always been in favour of a large portion of Government work being done by contract, and they, who were probably the best judges of naval work and mercantile engineering, and were the most competent persons to compose a jury, would have an opportunity of judging of the adaptability of these establishments to execute contracts with promptitude and efficiency. He thought, without indulging in prophecy, that they would be able to satisfy themselves of the competency and efficiency of these establishments to do any work that might be intrusted to them. He would like to allude to the papers about to be read, and which he thought were admirably adapted to the occasion and the locality. First and foremost came their president, Lord Armstrong, with his—he would not call them blushing honours, because he had never done anything in his life to be ashamed of—but his well earned and, by his neighbours, well appreciated honours. Lord Armstrong had found time to read a paper on a subject with which he was better acquainted than any man living, in the composition of which he has been aided by Mr. Vavasseur, whom they hoped to listen to in subsequent discussion. Then there was Mr. Frank Marshall, at the top of the tree of engineering profession, with the latest developments in engineering science. Their worthy friend, Mr. Messent, engineer of the Tyne Commissioners, would read to them an interesting historical review of the development of the commercial

resources of the river within the last thirty or fourty years. He had next to mention a man who had attained a position unequalled in Europe, by his own genius, industry, and resource—he referred to his warm friend, Mr. White, chief constructor to the navy, who would read a paper on the subject of the manufacture of steel, with special reference to the basic process, so largely adopted in the manufacture of steel in the neighbouring district of Cleveland. Mr. Martell was another extremely high authority whom they would hear. This gentleman had done more than any other man in the great cause of saving life at sea, and he reminded them that among the high functions of the Institution of Naval Architects that they were not only charged with the construction of our line of defence, with the maintenance of our commercial supremacy, but they were also charged with the duty of saving life at sea, and in that respect vast progress had been made in the types and character of our ships, both in the navy and mercantile service. Although critics might say there was little diminution observable in the loss of life at sea, he would say in the presence of men who knew that if blame was to be attached anywhere, it must be in some other direction than that of the improvement of sea-going vessels. He believed their mercantile engineers and naval architects had done their part of the work, and it was very difficult to find fault or speak of the want of success of their efforts of late years. Mr. Martell had also done more than any other man to solve one of the most difficult questions ever raised, namely, the load-line, because, by his exertions in that admirable institution, Lloyd's, a load-line had been arrived at which, while it gave the minimum of interference with the shipowners, provided something like a safety line for sea-going vessels. He again thanked them for the cordial reception they had given to the institution.

As might naturally be expected in such a great centre of ordnance manufacture and marine engineering, the first papers down for reading were two relating respectively to naval gunnery and the development of marine engineering. Lord Armstrong, in the first, sounded the key-note to the scientific proceedings that were to follow by a very valuable paper, the joint production of himself and Mr. Josiah Vavasseur, on "The Application of Hydraulic Pressure to Naval Gunnery." As this paper is dealt with in our Editorial Notes, we must content ourselves by saying here that in terse and lucid language, and in an admirably popular style, the gradual stages of transition from the old to the new era of naval gunnery were explained and treated by the authors as necessary processes of evolution demanded by altered times and the present conditions of naval architecture and scientific warfare.

The second paper, by Mr. F. C. Marshall, dealt with "Recent Developments in Marine Engineering," and as this will be given fully and illustrated in an early issue, we will forbear comment here.

Sir John Hay, Mr. Vavasseur, and Mr. W. H. White took part in the discussion on Lord Armstrong's paper, while Mr. Parker, Sir J. Lowthian Bell, and Mr. Kirk took part in a short discussion on Mr. Marshall's paper, which discussion was then adjourned to Thursday.

After the reading of these papers, the members were conveyed to Elswick, where, on the invitation of Lord Armstrong's firm, they partook of an excellent luncheon, and inspected the works and shipyard, the latter of which occupies 16 acres of "made" ground, and has a river frontage of about 2,000 feet, with a depth of water along the finishing jetties of 26 ft. at low tide, and 36 ft. at high tide.

Among the many objects of interest that were seen we may briefly mention the British man-of-war *Victoria*, having a displacement of 10,500 tons, and armed with two 110-ton guns in a single turret forward, a 10-inch gun aft, twelve 6-inch guns on the broadsides, and about thirty smaller guns. She has also six torpedo tubes. The main armour is 18-inch steel faced, while the turret is protected with similar plates of 17-inch thickness. The engines are of the vertical triple expansion type, and will indicate 12,000 H.P. under forced draught, steam being supplied from eight single-ended return tube boilers, at a pressure of 135 lbs. Afterwards the Chinese protected cruisers *Chih Yuen* and *Ching Yuen* were inspected, and a turret in course of construction for H.M.S. *Victoria* came in for a share of attention, while a 105-ton gun, lying on a bogey in the yard, attracted many visitors. This monster has a length of 40 ft. 10 in., and, by the aid of 900 lbs. of powder, hurls out a projectile only 240 lbs. short of a ton. Subsequently the company went to the forge, and from there to the carriage shop, the shell shop, the field carriage shop, the Hotchkiss carriage shop, and the finishing shop, thus completing a most agreeable and instructive excursion.

On Wednesday the members journeyed by special train at 9.15 a.m. to Sunderland, where they were officially received by the Mayor, shipbuilders, and engineers of the port, in the fine hall of the Subscription Library, Fawcell Street.

The Mayor in a very cordial speech, welcomed the Institution to Sunderland, and trusted that while this had been their first visit, it would not prove their last.

After the Earl of Ravensworth had thanked the Mayor in suitable terms, on behalf of the Institution, for the hearty welcome accorded to them, the reading of papers commenced.

Two papers, the first "On some recent experiments with basic steel," by Mr. W. H. White; and the second "On the present position occupied by basic steel for shipbuilding," by Mr. B. Martell were read.

These papers are dealt with in the Editorial Notes, so we need only mention here that the discussion on them was carried on by Mr. Gilchrist, Mr. James Riley, Mr. John Price, Mr. John Cassell, Mr. John Rogerson, Mr. George J. Snelus, Mr. Hutchinson, Mr. F. J. Trewent, and Mr. Craig.

After the discussion, the meeting adjourned to luncheon, provided in the Assembly Hall, on the invitation of the General Committee. At the conclusion of the luncheon proceedings, the members were conveyed to the chain, cable, and anchor-testing work of the River Weir Commissioners, where Mr. Harness, manager of the works, explained the nature of the operations carried on, and also carried out some tests before the members. There are three testing machines, having a combined power of 350 tons. The maximum power of the largest is 150 tons, and this machinery is capable of testing chains, cables, and anchors, large enough for a steamer of 6,000 tons registered. The machines are all of the horizontal type for tensile straining, the strain being applied from an hydraulic accumulator loaded to a pressure of 2,000 lbs. on the square inch. In the demonstrations made before the members a sample of 1⅞ in. was strained to 83 tons, which it withstood. It was afterwards submitted to a strain of 90 tons, by which it was broken. The length from which the sample was taken was then put to the tensile strain, and successfully withstood it. The experiments concluded with the testing of a Roger's anchor, and after inspecting a collection of patent anchors, which were on hand, the company left the works. After leaving the testing department the members embarked on board two steam tugs in the docks, and were conveyed to the pier works, where, on landing, an inspection was made of the massive blocks of concrete intended for the construction of the new piers. The party were conducted through the Commissioners' property to the Roker Pier, which is now about half finished. It is now nearly two years since the first large block of concrete was laid, and about 1,400 ft. of the pier has now been completed. The total length when finished will be 2,760 ft. It is intended to continue the south pier from the present lighthouse by 1,700 ft., so that when the projected works are completed there will be an area of water space within the piers at low water of 55 acres. On the arrival of the party, arrangements were at once made for laying a block of concrete, and accordingly a block weighing 43 tons was drawn by an engine to the pier end, and was then hoisted and placed in position by the massive crane. Lord Ravensworth, on the invitation of Mr. James Laing—who informed the members of the institution that their visit to Sunderland was about to be immortalised—stepped down to the place, and then mounting the concrete block by means of a ladder said, "Gentlemen, I declare this stone well and truly laid. It bears an unworthy name, but, by the blessing of God, I hope it may commemorate one of the most agreeable excursions which the Institution of Naval Architects have paid to the coast of this country, and form an important part of the enterprise undertaken by the Wear Commissioners and the people of Sunderland." A smaller stone was afterwards placed in position beside the larger block, and this bore the following inscription:—"Ravensworth, 27·7·87." This ceremony concluded the visit to Sunderland, and the members afterwards returned to Newcastle by special train.

In the evening the Mayor and Mayoress of Newcastle held a conversazione in the art galleries of the Exhibition, in honour of the visit of the Institution to their city, and although the visitors had been spending the day at Sunderland, a large number availed themselves of the invitation. Among those present were the President, Lord Ravensworth; Mr. Doxford, the President of North-East Coast Institution; the members of the Reception Committee; aldermen and councillors of the city, and the chief magistrates of adjoining towns; representatives of the Exhibition executive, members of the clerical, legal, and journalistic professions, Admiral Lang, and other Chinese officers, etc. In all, 1,230 invitations were sent out, and the Mayor and Mayoress are

to be congratulated upon the success of their efforts and the very pleasant and agreeable evening they enabled a large company to spend.

On Thursday morning the business of the Institution was resumed in the lecture hall of the Literary and Philosophical Society, Westgate Road, the president (Earl Ravensworth) in the chair. There were also present:—Admiral Sir John Hay, Mr. B. Martell, Mr. J. C. Stevenson, M.P., Sir B. Browne, Col. Swan, Mr. F. Marshall, Sir J. Lowthian Bell, Mr. Wigham Richardson, Mr. Arthur Coote, and others.

The PRESIDENT then called upon the Secretary to read the list of names of new members and associates who had been recommended by the council for election. They were as follows:—For members: Sir B. C. Brown, and Messrs. Wm. Alleson, Nelson Foley, A. J. Maclean, Thomas Mudd, J. R. Perrett, J. K. Rennie, John Renton, W. R. Steele, R. O. Ullstrom, Arthur Gulston, Lowrey Rusden, Thos. Milban. Hartley Campbell, T. Kellner, Stanley Fatham, and W. B. Thompson. For associates the following gentlemen were proposed: Messrs. Matthew Cay, H. F. Clarke, T. S. Cookes, W. Dulton, J. Fenwick, jun., Percy C. Gilchrist, A. P. Hoparth, R. M. Hudson, jun., J. Knott, R. W. Laidley, J. Pyman, F. Ritson, J. Rogerson, W. Boaz, J. Marr, E. Scott, J. B. Adam, A. C. Adam, W. J. Baxter, Robt. Morton, F. T. Marshall, Wm. Cross, J. H. Ridley, J. H. Sneius, D. Evans, W. H. M. Ellis, J. A. Walker, and H. B. Watson.

The list was unanimously adopted, and the President congratulated the Institution on such a considerable addition to its numbers.

The PRESIDENT next proposed an alteration in the rules by which in the future the election of the council would be in sections of one-fourth instead of as a whole, so as to give continuity, as far as possible, to the policy of the council, and this was unanimously agreed to.

The PRESIDENT then suggested that as the discussion on Mr. Marshall's paper on marine engineering would be very incomplete and exceedingly difficult without the diagrams, which have not arrived, Mr. P. J. Messent's paper on the development of the great works of the Tyne should be first taken. In his unavoidable absence, it would be read by the chairman of the River Tyne Commission, Mr. J. C. Stevenson, M.P.

As Mr. Messent's paper on "Tyne Improvements" is noticed in our Editorial Note in our present issue we will make no further comment on it here. After the reading of Mr. Messent's paper it became necessary to adjourn the meeting to the New Memorial Hall, this step being rendered necessary by the bursting of a gas pipe.

In the adjourned discussion on Mr. F. C. Marshall's paper, which followed the reading of Mr. Messent's paper, the following gentlemen took part, viz., Mr. Fothergill, Mr. J. D. Millburne, Mr. Rennie, Mr. McFarlane Grey, and Mr. W. H. White.

After luncheon in the Town Hall, given at the invitation of the general committee, the members made an excursion down the river from Newcastle, two boats being placed at their disposal. There were the *J. C. Stevenson*, belonging to the River Tyne Commissioners, and the *Alice*, lent by Mr. John Rogerson. Both boats left the Fish Quay, the first-named leaving first. The arrangements for the two trips were slightly different, those on board the *J. C. Stevenson* making a call of inspection at Messrs. Palmer & Co.'s Jarrow establishment, and then proceeding down to the Pier works, while those on the *Alice* called at two of the yards on the north side of the river. Dealing with the *J. C. Stevenson's* trip first, we may say that she had on board the President and a numerous company, including the gentleman after whom she is named, who kindly explained to the guests the various points of interest *en route*. On starting from the Fish Quay, the vessel steamed up the river for a short distance, and then, swinging round, passed down through the swing bridge, which was specially swung for the benefit of the visitors, who were particularly struck with the easy manipulations of the large piece of machinery. After this nothing of note occurred until Palmer's works were reached, and here Mr. Price was waiting to do the honours, and on the arrival of the boat at once proceeded to conduct his guests over the colossal establishment. The five great departments were visited in turn, and everything of interest was pointed out to the visitors. These departments may be briefly described as:—First, the blast furnaces, four in number, and each 85 ft. high. These are capable of producing 120,000 tons of pig iron per annum, a yield at present reached, the larger half of which is hematite pig iron, suitable for steel manufacture, both by the Siemens-Martin and Bessemer processes. Second, the rolling mills, where, when in full work, 52,000 tons of finished iron, of every required section, is produced annually. Third, the steel works, where the ingots are reduced by cogging mills driven by engines indicating, when required, 6,000 H.P. Fourth, the engine works capable of turning out annually 8,000 H.P., the usual brass and iron foundries, forges, coppersmiths' shops, etc., were inspected in this department. The fifth and last department inspected was the shipbuilding yard. This consists of fourteen launching berths (including six in the Howdon yard on the opposite side of the river) adapted for the construction of the largest vessels for war or commerce, and capable of turning out 70,000 tons of commercial shipping annually. In 1882 and 1883 over 60,000 tons each year were sent afloat, since which time, however, the capabilities of all departments have been increased and are now capable of doing fully the above work. After the inspection an adjournment was made to the offices, where wine and light refreshments were served, and where, at the suggestion of Lord Ravensworth, the health of the host was enthusiastically toasted. The party again boarded the *J. C. Stevenson* and proceeded to the harbour, where the piers were inspected and the pier extension operations were watched for some little time. A landing was then effected at the north side and the party returned to Newcastle by special train from Tynemouth. Those on board the *Alice* also witnessed the easy working of the swing bridge, after which they parted company with the *J. C. Stevenson*. The *Alice* was subsequently brought alongside the *Drudge* at Messrs. Armstrong, Mitchell & Co.'s shipbuilding yards, Low Walker, and the company soon mounted the deck of a handsome steamer, the *Minister Maybach*, one of a fleet of petroleum steamers which the company have in hand. They are all built on the conical bottom system as patented by Mr. Swan. The "oil boat," with a capacity of 3,000 tons, is ready for delivery; another is all but finished; a third will be ready for launching in a few days, and there are other two on the stocks, so that this particular firm cannot complain of slackness. After inspecting several machines, where 1½ in. steel plates were being straightened, punched, &c., much as if they were merely sheets of paper, the visitors were hospitably refreshed in the model room before leaving for another visitation. The works next visited were those of Messrs. Wigham, Richardson & Co., who had four ships on the stocks, one of 5,000 tons, another of 3,000 tons, an Italian steamer of 2,000 tons and 15 knots, and a small steamer of 200 ft. long, which is also to do 15 knots. The engines building for these and other steamers were also inspected, and after a most enjoyable outing the members rejoined the *Alice*, which conveyed them to Tynemouth pier, from whence they trained back to Newcastle.

The annual dinner of the Institution took place in the evening in the principal dining saloon of the Newcastle Exhibition. About 200 gentlemen were present. The Earl of Ravensworth, who occupied the chair, was supported by the Mayor of Newcastle (Sir B. C. Browne), Sir Charles Mark Palmer, M.P., Mr. J. C. Stevenson, M.P., Mr. R. S. Donkin, M.P., Admiral Sir John Hay, Bart., Mr. W. T. Doxford, Mr. W. H. White, Mr. B. Martell, Mr. Henry Laird (Birkenhead), Mr. John Price (Jarrow), the Mayor of Sunderland (Mr. Edwin Richardson), Mr. F. C. Marshall, Mr. George Crawshay, Mr. F. K. Barnes, Mr. J. Macfarlane Gray, Mr. H. H. Wake (Sunderland), Mr. Arthur Coote, Mr. Wm. Parker (Lloyd's), Mr. Wigham Richardson, Mr. John Rogerson, Mr. G. B. Bruce, Mr. G. Holmes (secretary of the Institution), Mr. J. Duckitt (secretary of the North-East Coast Institution), Mr. B. G. Nichol (hon. treasurer), and others. After the usual royal toast by the chairman, Sir John Hay proposed "The Houses of Parliament," which was responded to by the Earl of Ravensworth and Mr. J. C. Stevenson, M.P. Mr. B. Martell then proposed "The Mayor and Corporation of Newcastle-on-Tyne," to which the Mayor (Sir B. C. Browne) replied. The Chairman then gave, "The North-East Coast Institution of Engineers and Shipbuilders and the Reception Committee." This called forth replies from Mr. Doxford and Mr. Duckitt. Mr. W. H. White followed with "Prosperity to the Trade and Manufactures of the North-East Coast," and to this Sir C. M. Palmer and the Mayor of Sunderland (Mr. E. Richardson) responded. The Mayor of Newcastle finally proposed "The Health of the President of the Institution of Naval Architects," and his lordship having returned thanks. the proceedings terminated.

On Friday, the final day of the session, the members were astir early, and left the Central Station at 9.55 a.m. for Consett, by special train, to visit the works of the Consett Iron and Steel Company, Limited. The visitors, about 200 in number, were headed by Mr. W. T. Doxford and Mr. B. Martell, and were received on arrival by Mr. Jenkins, the general manager of the works. The Consett Company's property consists of extensive

collieries, producing coals of the finest Durham quality to the extent of over one million tons annually; coke ovens, which produce about 500,000 tons of coke annually; brick works, with a capacity of 150,000 bricks per week; seven blast furnaces, each capable of producing 800 tons of high-class Bessemer pig per week. In addition, there are eight Siemen's melting furnaces of large capacity, and two rolling mills, from which about 1,000 tons per week of mild steel plates are produced. After inspecting the works and other additions thereto in course of construction, the visitors betook themselves to the Town Hall, where they were entertained to luncheon by the Consett Company. Here the usual loyal and other toasts were given, and shortly afterwards the members returned to Newcastle by special train, and so terminated one of the most interesting and most enjoyable summer sessions that the Institution of Naval Architects have yet held.

THE SUMMER MEETING OF THE INSTITUTION OF MECHANICAL ENGINEERS.

THE Institution of Mechanical Engineers selected Edinburgh for the customary summer meeting this year, the proceedings commencing on Tuesday, August 2nd, and terminating on Friday, August 5th.

The opening meeting commenced at 9.30 a.m., on Tuesday, with the reception of the President and members in the University Library Hall by the Marquis of Tweeddale, chairman, and other members of the local committee, the magistrates, &c. Upwards of 300 members put in an appearance at the reception, and after a cordial welcome by the Marquis of Tweeddale and Sir William Muir, on behalf of the university, for which the President (Mr. E. H. Carbutt) returned thanks, the meeting adjourned to the Natural History Lecture Theatre, where, after the transaction of some formal business, the secretary read Mr. E. Malcolm Wood's paper on "The Structure and Progress of the Forth Bridge." Giving at the outset as his reason for offering the paper a desire to place the members in possession of a description of the structure and progress effected before their visit to the bridge, the author then alluded to a previous proposal, and further told his hearers how the present design of a canti lever and central girder system came to be adopted. The writer then went on to state that the total length of the bridge will be 8,300 ft. There are two main spans of 1,700 ft. each, two side spans of 675 ft. each, with the ends counterbalanced and anchored to the masonry, the remaining length being made up of three intervening piers and fifteen approach spans of 168 ft. each, together with masonry arches and abutments. For a length of 500 ft. in the centre of each of the two 1,700 ft. spans there is a clear headway for navigation of 150 ft. above high water. From the base of the deepest pier to the top of the canti levers the total height is 450 ft. In addition to its own weight the bridge is being constructed to support a load equivalent to trains of unlimited length, or one ton per foot run on each line of rail, and also to withstand a lateral wind pressure of 56 lbs per square foot of exposed surface of trains and structure. This pressure acting on the mile length of main spans only would amount to over 8,000 tons. In addition to lateral winds, the direction from any point of the compass has been provided for, even including the imaginary condition of each group of main piers becoming the centre of a whirlwind. Effects of temperature were efficiently guarded against. Forty-eight 2½ in. steel bolts, secured 24 ft. down in the masonry hold down the bed plates with an initial tension of 2,000 tons. The maximum pressure on the base of the piers will be a little over 6 tons per square foot.

The enormous forces to be resisted have been met by adopting the most suitable forms of parts for withstanding the stresses. Tubular members are used for compression, and open braced box forms for tension. The masonry for the main piers above the whinstone concrete filling up the caissons, consists of a casing of Aberdeen granite, enclosing and bonded into a hearting of Arbroath stone set in cement, and strengthened by three massive wrought iron belts built into the stonework. The deepest pier weighs about 20,000 tons. For the principle members of the superstructure subject exclusively to compression, the steel used has a tensile strength of 34 to 37 tons per square in., with at least 17 per cent. of elongation in a length of 8 in.; for the other parts 20 per cent. of elongation, with 30 to 33 tons tensile strength. The rivet steel has 25 per cent. elongation and 26 to 28 tons tensile strength. No sheared edges or punched holes are permitted. Over 3,000 hands have been employed continuously for the past year, while during the present summer months the number has been 3,600. 550,000 cubic feet of granite and 21,000 tons of Portland cement have been delivered up to the present time, and the amount thus far erected has been, masonry in piers and abutments, 129,500 cubic yards; steel in approaches and main spans, 19,000 tons; steel prepared ready for erection, 20,000 tons. Hydraulic power is freely used, from the extremely neat form of shop crane to the 2,000 ton press for curving the tube plates. With the exception of the main pier caissons made by Messrs. Arrol Bros. of Glasgow, and the superstructure of the approach spans by Messrs. P. & W. Maclellan, of Glasgow, the whole of the work has been turned out of the shops at the bridge, their present capacity being an output of 1,300 tons of finished work per month. Mr. Malcolm then went on to describe the progress of the earlier work, and the tedious process of sinking the caissions, afterwards touching upon the method of erecting the steel work over the main piers, and going fully into the details of erecting the canti levers. The Chairman complimented Mr. Wood upon his paper, and remarks were also made by the Marquis of Tweeddale, Mr. Daniel Adamson, Mr. Stead, Mr. Marten, Mr. Strype, Mr. Cochrane, and Mr. Cawley.

This was followed by Mr. Arrol's paper on "Notes on the Machinery employed at the Forth Bridge." In opening, the author called attention to the unusual nature of the work to be carried out, necessitating originality of design in the various machines. To bend and twist the large steel tubes a great variety of hydraulic presses had to be provided, the largest, exerting a pressure of 1,600 tons between the dies, consists of four 24 in. cylinders, resting on two longitudinal girders bedded in concrete. From each cylinder rise two iron columns carrying a fixed table overhead, while the top of the rams carry another table, and between these two tables are placed the blocks which stamp the plates to the desired shape. In nearly every case, after a plate has been set while heated, it requires to be finally adjusted when cold. In no instance is this plan of bending adopted to any extent without annealing the plates both before and after the work has been but upon them. Numerous other forms of presses are employed for lighter work.

For planing the ends of the curved plates a special machine is used. In this the plates are secured to a fixed table, while the tool is made to travel backwards and forwards in a swinging pendulum, receiving its motion through a connecting rod from a travelling saddle. The tool cuts both ways, and is fed by hand. For drilling the finished tubes, the machines, each complete in itself, are made large enough to embrace the entire circumference of the tube. They consist of a wrought iron under frame, on which are placed the engine and boiler. On it are also fixed two large cast-iron annular rings or head-stocks embracing the tube, and round which ten drilling slides and heads travel circumferentially. The slides are moved around the rings by a worm at each end gearing into a worm wheel that forms part of the rings. The motion of the drill heads is longitudinal, or parallel, to the tubes. These two motions permit of the ten drills working at any part of the circumference of the tube comprised between the two annular rings spaced 8 ft. apart. In the case of the lighter tubes about 800 holes are drilled per shift of ten hours. To erect and rivet such large quantities of material at the immense height at which much of it is required to be done, demanded a large quantity of special plant for riveting and other purposes, and these the author describes at length. In the discussion on this paper, Mr. Platt. Mr. D. Adamson, Mr. Walker and others took part, all of whom commended the machinery for its ingenuity and adaptability to the work to be done.

The next paper read was by Mr. F. J. Rowan, "On Electromagnetic Machine Tools." As we purpose giving this in full in an early issue, a mere reference to it here will suffice. The reading of this paper concluded the indoor proceedings for the day, and after a light luncheon in the Student's Reading-room of the University by invitation of the local committee, the members went by special train from Waverley Station to the Forth Bridge Works, where, under the guidance of the resident engineer and the contractors, they were shown the various processes and objects of interest. Returning by special train from Newhall's Station, the members were in time to attend the annual dinner of the Institution in the Masonic Hall, Edinburgh. The dinner was well attended, and was in every way a most enjoyable one. On Wednesday morning the conference was resumed, under the presidency of Mr. E. H. Carbutt, in one of the lecture-rooms of

Edinburgh University. Four papers were down for reading, but time only permitted of three being dealt with. The first of these, "Description of the Electric Light on the Isle of May," by D. A. Stevenson, B.Sc., will be given fully in an early issue. The second, "Description of the New Tay Viaduct," by Mr. F. F. S. Kelsey. With the exception of the leading dimensions and a few other particulars, the paper contains little to interest our readers, and we will therefore deal briefly with it. The new bridge is 33 ft. short of two miles, there are in all 85 spans, and 73 of the piers have cylinder bases. The various materials used in construction were, wrought iron in girders and piers, 19,337 tons; steel in flooring, 3,540 tons, cast iron, 2,470 tons; cement, 37,000 cubic yards; brickwork, 25,700 cubic yards. The construction was commenced on June 22nd, 1882, and it was opened for traffic June 20th, 1887, just five years after. The discussion on this paper was limited to a few technical questions.

The next paper, by Mr. C. A. Stevenson, B.Sc., "On the Dredging of the Lower Estuary of the Clyde," was then read. The author showed how, from the year 1768 to the present time, the Clyde has been converted from a fordable stream into a maritime canal capable of taking up to Glasgow in one tide vessels of 5,000 tons and drawing 24 ft. of water, and then, after setting out the scheme of improvement, proceeded to describe the dredger, which cost £19,250, and three screw hopper barges, which cost in all £22,571. The dredger has a length over all of 164 ft., a breadth of 30 ft., and draws 9 ft. of water aft. The engines are compound, with cylinders of 23 and 44 in. diameter and a stroke of 30 in., and make 70 revolutions per minute with 80 lbs. of steam. The paper stated that during one year's working in soft stuff the dredger removed 408,895 cubic yards at the rate of 212 cubic yards per engine hour, and at the cost of 2·54 pence per cubic yard, including repairs, &c., and interest and depreciation at 10 per cent. Conveying and depositing the stuff in Loch Long, 7 miles distant, cost 2·47 pence per cubic yard. The total cost of dredging and depositing was therefore 5·01 pence per cubic yard. During four years' working the average rate was 166 cubic yards per engine hour. In clay and sand the work for many days consecutively has been 3,500 tons per day of ten hours, or at the rate of 350 tons per hour; but with careful manipulation 500 tons can be raised in 51 minutes easily, and this has once been accomplished in 45 minutes. In dredging the "hard" of Gravel Point, however, which is a very stiff clay packed with boulders—presenting the most severe ordeal that a dredger could be put to—the work fell as low as 57 tons per hour, costing 18·03 pence per cubic yard, or more than three times what it cost to dredge the soft.

Remarks having been invited, Mr. Deas, engineer to the Clyde trustees, said the paper only dealt with a very small portion of the river, and, on the invitation of the secretary, he had handed in a short history of the improvement of the Clyde from Port-Glasgow, where Mr. Stevenson's jurisdiction ends. Nothing, he said, showed more clearly the value of the dredging operations than the fact that the time the tide took to reach Glasgow had been accelerated by two hours. In 1871, 59 ships of a maximum draught of 21 ft. 7 in. grounded in the Clyde; while last year there were only 16 groundings, the maximum draught being 24 ft. 7 in. In 1858 a float put in on the first ebb at Glasgow Bridge took 537 hours, or 43 days, to be carried 19½ miles; while in 1881 a float set down in similar circumstances travelled 23½ miles in 86 hours.

Other gentlemen took part in the discussion, and the proceedings then terminated with votes of thanks to the Chancellor, Principal, and Senatus Academicus of the University for their kind invitation to hold the meeting in the University, and for the important facilities they had obligingly afforded for this purpose; to the Edinburgh and Dundee Reception and Executive Committees; to the chairman, the Marquis of Tweendale; to Mr. St. John V. Day, the hon. local secretary in Edinburgh; and to Professor Ewing, the hon. local secretary in Dundee; to the Lord Provost and Magistrates of Edinburgh, for the invitation to the conversazione; to the engineers of the Forth Bridge; to the Commissioners of Northern Lights, and Engineers of Waterworks, &c.; and to the chairman and directors of the North British and Caledonian Railways, for their kindness in arranging special trains for the convenience of members in the various excursions.

After a light luncheon in the students reading room of the University the members were given the alternative of one of five excursions, but we will content ourselves by describing that to the Carron Iron Works, the other being to the Addiewell, Broxbourne, and Burntisland Oil Works, and the Kirkcaldy Floorcloth Works. A special train started at 1.40 p.m., for the Carron Iron Works. Upwards of two hundred members of the Institution joined the excursion, at the head of which, as representing the executive, were Mr. A. B. Marten, of Stourbridge, and Mr. Benjamin Walker, of Leeds. Among the other gentlemen present were Messrs. W. C. Shackelford, of Lancaster; H. A. Ivatt, Great Southern and Western Railway, Dublin; E. Disdier, Bilbao; Arthur King, Birmingham; W. W. Clayton, Leeds; W. H. Greenwood, Firth College, Sheffield; J. B. Cochrane, Stourbridge; H. Davey, London; T. Mudd, West Hartlepool; W. Swinburne and J. Bulmer, Newcastle-upon-Tyne; J. G. M'Gregor, Halifax; M. Spencer, Manchester; S. W. Allen, Cardiff; John Craven, Leeds; Joseph Adamson, Hyde, &c. Arrived at the journey's end at 2.50, the party, under the guidance of Mr. Cowan, general manager, and eighteen heads of departments, were conducted over the extensive works. They first visited the stove-range brickworks, where the bricks required for the stoves, ranges, and grates produced in the works are manufactured from fire-clay produced from the adjoining colliery. The Heavy Foundry, which is undergoing great modification and enlargements, and where castings up to 30 tons are turned out, was next visited; and the party then proceeded to the blast furnaces. Two of the former furnaces have closed tops and are fitted with regenerative hot-blast stoves, and have a weekly output of 220 tons, as against 180 tons produced from the two open-topped furnaces which work with pipe stoves. It was explained that as the furnaces work on raw coal, the large surplus of gas in excess of that required for heating the blasts to a temperature of 1,400 degs. to 1,500 degs. Fahr., and raising the steam for the blowing engines, is being utilised as fuel in other departments. Ultimately, no raw coal will be used in the works except that put into the blast furnaces; and with this object it is proposed shortly to blow in another furnace, but before doing so certain improvements are being carried out which, it is hoped, will still further reduce the cost of production, and yield a full supply of gas for all departments of the works. Afterwards, in succession, the hydraulic and fire-extinguishing arrangements; the mould-shop and cupolas; the dressing, pattern, brassfinishing, tool, sheet-iron, and forging shops; the grinding-mill and the fitting and machine shops, where torpedo work ordered by the Government was being turned out, were visited, under the direction of Mr. Cowan, to whom the representatives of the Executive expressed their sense of his courtesy, and of the interest and admiration with which they had noted the resources and facilities which the works contained for the manufacturing and moving of material, and of the great cleanliness and airness of the different departments. They were impressed with the success of the efforts made to reduce the cost of manufacture to the lowest point, and to reduce labour also to a minimum, and were persuaded that with a revival of trade a great development would be found in the department of the smaller castings of domestic and sanitary utensils and the like, for which the Carron iron, from the fineness and softness of its quality, is specially suitable. A repast of cake, wine, and fruit was spread in the sample-room, where also a number of small specimen castings and wrought-iron forgings and turnings were presented to the guests. Mr. Cowan, in proposing the healths of the members of the Institution, expressed the regret of Mr. T. D. Brodie, the principal partner of the Company, at being unable to be present. Mr. Walker, on behalf of the visitors, thanked Mr. Brodie for his hospitality, and Mr. Cowan for his attention, and proposed their healths in turn. The party left at 4.40 arriving at Edinburgh at 5.50 p.m.

The Lord Provost, Magistrates, and Council of the city gave a conversazione in the evening, in the Museum of Science and Art. Between 3,000 and 4,000 invitations were issued from the City Chambers, and about half of these, judging from the attendance of ladies and gentlemen, were accepted. The company began to arrive shortly before eight o'clock, and the usual reception ceremony, which occupied rather more than an hour, terminated on the arrival of the President of the Institution. In the unavoidable absence of Sir Thomas Clark, the guests were received by Bailie Anderson, who was supported by Bailies Roberts, Turnbull, Russell, and Walcot, Treasurer Boyd, Councillors Clapperton, Ritchie, Tait, Bryden, Gibson, Macdougald, Maclaren, and Brown, and Mr. Skinner, Town Clerk. Behind the members of the Corporation, who wore their robes of office, stood the halberdiers, while a guard of honour was provided by office-bearers of the Edinburgh High Constables. After bowing to or shaking hands with the Magistrates, the guests dispersed themselves throughout the Museum, several hundred later on attending in the new west wing, and listening to a lecture by Sir William Thomson. Among those present were:—Mr Edward H. Carbutt, London, President of the Institution; Mr. Jeremiah

Head, past president; Mr. Charles Cochrane, Mr. Joseph Tomlinson, jun., Mr. Arthur Paget, Mr. Daniel Adamson, vice-presidents; Sir James Douglas, member of the Council; Mr. T. Hurry Riches, member of the Council; Mr. R. Price Williams, member of the Council; and Mr. Alfred Bache, secretary; Mr. St. John V. Day, honorary local secretary in Edinburgh; Professor Ewing, honorary local secretary in Dundee; Colonel Malcolm, C.B.; Mr. R. C. Reid, C.E., members of the Executive Committee; the Marquis of Tweeddale, chairman of the Edinburgh Reception Committee; Sir William Muir, vice-chairman, Sir William Thomson, vice-chairman, Professor Armstrong, vice-chairman; Professor Crum Brown, member of the Edinburgh Reception Committee, and Mrs. Crum Brown; Mr. William Dyce Cay, C.E., member of the Edinburgh reception committee, and many others.

At nine o'clock about three hundred of the company assembled in the new hall at the west wing, the interior of which is still incomplete, to hear a lecture by Sir William Thompson on "Waves." The Marquis of Tweeddale presided, and amongst others on the platform, including several of the municipal representatives, were Sir William Muir, Principal of the University; Professor Crum Brown, Mr Edward H. Carbutt, President of the Institution; and Colonel Malcolm, C.B. The Chairman briefly introduced Sir William Thomson, who proceeded to speak for about an hour and a half, treating his subject mainly in a scientific aspect. He first explained the series of waves—those of water, light, sound, and of earthquakes. Generally defined, he said, a wave was a progression through matter in a state of motion. The distinction between the progress of matter from one place to another and the progress of a wave from one place to another was well illustrated by the very largest example of waves that we had, namely, waves of light. Let them think of a wave of light coming from a star known to be at such a distance as 93 millions of millions of miles. Of all the beautiful forms of waves, ship waves—with which they were concerned then—were perhaps the most beautiful. In mathematical science they possessed a special and intense interest, partly from the difficulty of the problem they constituted, and partly from the peculiar complexity of the circumstances concerned in the configuration which was seen. Sir William then went on to deal at length with canal and other waves.

On Thursday the members to the number of about 400 made an excursion to Dundee on the invitation of the Dundee Reception Committee, journeying from Waverley station by special train. The Tay Bridge was reached about noon, and as the train slackened speed going across the viaduct, the passengers had an admirable opportunity of viewing the upper portion of the structure, and of judging of the stability of the top framework. Arrived at Dundee, the company found a large number of brakes in waiting to convey them to the principal works and places of interest in the town. Each conveyance was ticketed with its destination, so that members had a choice of the works to be visited; and in general they selected those the operations in which had for them a special interest. A large party drove to the Tay Jute Works, belonging to Messrs. Gilroy, Sons & Co., and were shown over the mills by one of the firm. Great interest was evinced by the visitors in the various processes by which the raw jute fibre is transformed into tough sacking, pressed, and packed ready for exportation. Much pleasure was derived by other parties who were shown over the Seafield Jute Works of Messrs. Thompson, Shepherd & Co., and the Manhatten Jute Works of Mr. E. S. Sandeman; while those who visited the Blackness Foundry of Messrs. Urquhart Lindsay & Co., and the Dundee Foundry, owned by Messrs. Gourlay Brothers & Co., were delighted with their inspection.

The works belonging to the latter firm have existed for three or four generations, and have by constant additions been brought up to the requirements of the present day for turing out the heaviest and best class of marine work both rapidly and economically. They are fitted with the latest improvements in machinery and hydraulic appliances. Among the larger cranes is a 50 ton traveller over the erecting shop, and two 30 ton travellers over the moulding shop, which has been recently erected and is capable of turning out the heaviest castings very rapidly; over the boiler shop there are two travellers of 15 tons and 30 tons capacity respectively; while in the boiler yard there is in course of erection a 30 ton steam derrick crane for the hydraulic rivetter and the handling of heavy plates. The works are driven by a tandem compound engine and the power is communicated by rope and friction gear.

A special feature of interest is a very old beam engine which has only recently been laid aside and is the one which was originally experimented on by Mr. Stirling, who converted it into a hot-air engine; it ran for some time so altered, but was eventually reconverted to steam. Of his celebrated engine built here in 1843 no relics now remain. We noticed the various parts of an usually large set of triple expansion engines in course of construction at these works and of which we shall have more to say hereafter. Equal gratification was experienced by the members who devoted their time to the visitation of the Dundee Harbour and Harbour Works, and of the University College, with its chemical, physical, electrical and engineering laboratories. At two o'clock the members on the invitation of the Dundee Reception Committee sat down to a substantial luncheon in the Albert Hall, under the chairmanship of Provost Ballingall, who was supported by Mr. Carbutt, the President, and other prominent office bearers of the Institution. The luncheon over, the company drove down to the river, and embarked on board the *Dundee*, placed for the occasion at the disposal of the Institution by the Harbour Trustees, and sailed several times under the Tay Bridge. This enabled them to inspect the piers, and to view the viaduct as a whole. The impression created by the appearance of the structure was of the most favourable character; and comparisons between the piers of the new and the remains of those of the old structure were not infrequent. Leaving the vicinity of the bridge, the *Dundee* steamed down the Tay, past the *Mars* training ship, the boys of which gave a hearty cheer in response to one from the members. Returning to Dundee, the steamer sailed slowly past the shipbuilding yards. On board the company were hospitably entertained; and Mr. Carbutt expressed the prevailing sentiment when in a few appropriate sentences he proposed three hearty cheers for the Harbour Trustees for the use of the steamer and for their unbounded hospitality. The return journey in the special train from Tay Bridge station was commenced at half-past five, and Edinburgh was reached about a quarter to eight. In the Granton steamer a collection was made towards the Forth Bridge Workmen's Sick and Accident Fund, as a result of which a contribution of twenty guineas to that benevolent object has been forwarded to Mr. Benjamin Barker.

On Friday, the concluding day of the meeting, one of three alternative excursions could be made; to the Waterworks, under the guidance of Mr. Robert C. Reid, one of the engineers; to the Isle of May Lighthouse, by special steamer; and to the Royal Mining Engineering and Industrial Exhibition at Newcastle-on-Tyne. The party visiting the waterworks were conveyed in special brakes from the Scott monument to the works, and after inspecting these were taken on to Penicuick, where the paper mills of Messrs. J. Brown & Co. and Messrs. A Cowan & Son were open for inspection. Leaving Penicuick the party next proceeded to Gladhouse reservior, whence luncheon was served. After inspecting these the party left for home, inspecting Edgelaw reservoir *en route*. The party proceeding to the Isle of May made their way to North Leith, from whence they proceeded in the special steamer *Meteor* leaving the Victoria Jetty, Leith Harbour at 9.45. The company numbered about one hundred, and included Sir J. Douglas, Mr. Cochrane, Mr. Macfarlane Gray, Mr. H. H. Wake, Mr. Goulty, Mr. Menzies, &c. The whole of the arrangements of the electric lighthouse were explained by Mr. D. A. Stevenson, and after leaving the island the party were conveyed round the Bass Rock; an excellent luncheon being partaken of on board the steamer. Experiments were carried out with Sir W. Thomson's sounding apparatus during the trip, and were watched with much interest by those on board. We may mention that the *Meteor*, which was described on page 143 of our July issue, belongs to the London and Edinburgh Shipping Company, and was commanded by Captain Raison, the commodore of the Company's fleet. She is a handsome vessel, and fitted with every modern appliance to ensure comfort and safety. On a recent voyage between London and Leith she did the distance in 24 hrs. 35 mins., or an average of 16·3 knots throughout, the fastest passage on record between these two ports.

The third excursion to the Newcastle Exhibition was largely patronised by those members returning south, who took this on their way home. As the Exhibition is probably familiar to most of our readers by now we need make no further allusion to this excursion.

This day saw the close of one of the most successful and pleasant summer meetings that the Institution of Mechanical Engineers have as yet held, and it is no exaggeration to say that the success of the meeting was in great measure due to the untiring efforts of Mr. Bache, the able secretary of the Institution, Mr. St. John S. Day, who kindly acted as honorary local secretary in Edinburgh, and Professor Ewing, who acted in a similar capacity in Dundee.

ON COMPOUND ENGINES FOR ATLANTIC STEAMERS.*

(*Concluded from page 156.*)

IT seems to me a curious fact that while many engineers in setting their valves allow for the direct action of gravity on the moving parts, *i.e.*, their mere weight, which is constant at all speeds, no account is taken of the energy stored in these parts, although this varies with the weight and the square of the speed at which they move. There is another small point liable to be overlooked, viz., that while the weight of the pump connections —when levers are used—tends to counterbalance the weight of the pistons and main gear, it has the opposite effect as regards the momentum of these parts increasing instead of reducing it. These effects are only small, however, as the weight of the pump connections is small compared with the main gear, while the leverage and velocity is usually less than half. The resistance of the air pump due to the vacuum, however, acts as a counterbalance either to the dead weight or the momentum and should be allowed for in making a diagram of twisting moments.

Fig. 5 shows some diagrams from the troopship *Malabar*, after her engines were compounded, and these were taken at about her usual steaming speed. The engines originally had two 94 in. cylinders, with, I think, 4 ft. stroke, and are of the horizontal return connecting-rod type. When compounded it was necessary to fit an 84 in. high-pressure cylinder to take in the two piston-rods, and the largest low-pressure cylinder that could be got in was 110 in., so that the cylinder ratio is on 1 : 1·72; and in arranging the cut-off in low-pressure cylinder for this power, it has been set at a mean of $\frac{5}{8}$ stroke, which nearly represents the working capacity of the high-pressure cylinder; so that had there been no compression in that cylinder, and sufficient in the low-pressure to fill the clearance at the terminal pressure in high-pressure cylinder, there should have been no "drop" at the end of the high-pressure stroke; but as it is, the volume of steam admitted to the low pressure cylinder is about 25 per cent. greater than that discharged at terminal pressure from the high pressure. To equalise those volumes the cut-off in the low pressure cylinder should take place not later than half stroke, when the high pressure diagram would have ended quite sharply, and there would only have been the "drop" due to the friction of the steam in passing from the one cylinder to the other, and the wire drawing during admission to the low pressure. The earlier cut-off in low pressure cylinder would not only have reduced the "drop," but would have given more equal powers in the two cylinders. You will notice the peculiarity of the expansion curve, its greatest divergence from the hyperbolic curve being in the middle of its length.

Fig. 6 shows the diagrams of the s.s. *Westmoreland*, by Messrs. David Rolls and Sons, who have kindly supplied me with the cards and the clearance capacities. In all the other cases I have had to approximate to the latter from careful measurements of the compression curves. These diagrams show considerable loss of pressure both between the high pressure and intermediate and the intermediate and low pressure cylinders, while the intermediate cylinder seems to have a great deal of loss by condensation, from the way in which the diagram falls back from the theoretical curves, which here again are hyperbolic. The steam, however, appears to be re-evaporated considerably in the low pressure cylinder, as it approaches the theoretical curve pretty closely towards the end of the stroke in that cylinder. In a three cylinder triple-expansion engine with cranks at equal angles it is difficult to get rid of "drop," and at the same time maintain equality of powers in the several cylinders without very large high pressure and intermediate pressure cylinders, especially the latter, and without cutting off very early in the high pressure. I am not sure that a better result on the whole might not be gained by sacrificing the advantages of cranks at equal angles and placing the high-pressure and intermediate pressure cranks opposite to one another with the low-pressure at right angles to them, and then proportioning the cylinders and cut-offs so as to get unbroken expansion without "drop." Mr. Turner, of Birkenhead, has patented an engine of this type, the two first cylinders driving opposite cranks and working on the "Woolf" principle, one double-ended piston valve distributing the steam to both of them. This has the disadvantage common to all "Woolf" engines, that there two cylinders are in communication with each other during the whole stroke. This may, however, be avoided by the employment of an intermediate receiver and by cutting off early in the intermediate-pressure cylinder.

I shall now proceed to speak of the way in which I have combined these different diagrams, viz., that recommended by Mr. Schönheyder, and point out the defects in all the other methods I am acquainted with. Mr. Schönheyder's system is the only one that takes into account the effects of clearance and compression in all the cylinders, and gets the several cards into their proper places relatively to each other and the theoretical curves, and secures these curves, themselves being properly plotted. There are five different ways of combining indicator diagrams, all founded on the same general principle, and having certain points in common. They all have horizontal lines, which are zeros of pressure, and vertical ones, which are zeros of volume. The figures to be dealt with having been plotted to one scale of pressure and of lengths proportionate to the capacities of the several cylinders, are then placed in certain positions relatively to these horizontal and vertical zero lines, and the difference in the five methods lies in the horizontal placing of the figures. They all have also a theoretical curve or series of curves, to which the horizontal and vertical lines are assymptotes.

Now, the chief point to which I wish to draw your attention is that, in all the methods I shall describe, vertical ordinates or distances always represent pressure or density, and horizontal ordinates or distances always represent volumes or spaces. The products of these valves are quantities or weights of steam or work done, and are represented as areas. One way of combining diagrams is to disregard clearance spaces and compression altogether, and to place all the figures up against one vertical line or zero of volume. For one purpose and under one condition of distribution this is right enough, but only then. The one purpose is the mere comparison of the collective areas of all the actual cards with a standard area representing the work which could, theoretically, be obtained from the quantity of steam used expanded into a cylinder the same capacity as the low-pressure cylinder. But it is only correct for this one purpose under one condition—viz., when the cushioning in the high pressure cylinder is sufficient to fill the clearance at initial pressure. For comparing the actual pressure at any point in the expansion curves of the diagrams with the pressure which ought theoretically to exist at that point, this method is useless. And it does not give the correct theoretical expansion curves for the different cylinders, as these curves are due, not to the volume of steam admitted to the cylinders, but to the whole volume in the cylinder and clearance at the time of cut-off. A second method, and the one most generally used, is to place all figures at such distances from one vertical line as shall represent the whole clearance spaces in the different cylinders. This is less correct than the first method, as it neither gives the correct standard area to compare the actual figures with nor the correct relative positions of these figures to compare the pressures with those of the theoretical curve, and it only gives the theoretical curve correctly for the high-pressure cylinder. It neither takes into account the effect produced by compression in, say, the high-pressure cylinder in upon the quantity of steam discharged from that cylinder, nor that due to the clearance and compression in varying the volume of steam admitted into the next cylinder. I gives one continous curve for all the cylinders, which, as a gener rule, will be incorrect except with special proportions of clearanc and compression. A third method has been proposed and used b Mr. Mudd, of Hartlepool. He takes one zero line of volumes f all the cylinders, as in the previously described methods, but plac the separate figures at distances from it, proportionate only t that portion of the clearance unfilled by compression. That is t say, when the compression is sufficient to fill the clearance of a cylinder at half the initial pressure the distance = half the clea ance, and if the steam is compressed up to two-thirds the initi pressure the distance will be = one-third the clearance, and so o This plan is at least as incorrect as the last, as it neither gives t correct standard area for comparison, nor the correct positions diagrams in relation to the theoretical curve, and it makes th curve itself wrong for the same reason as method No. 1. I ha seen in one instance a fourth way of combining diagrams, a that was to place the high-pressure figure at a distance from vertical line representing the clearance of that cylinder, and th to put the other figures at the same distance from the vertical the high-pressure figure. After what I have said already, it hardly necessary to criticise this method.

In the method described by Mr. Schönheyder neither the z line of volume nor the theoretical expansion curve is necessa the same for all the cylinders. He proceeds as following:—Hav placed the high-pressure figure at its proper height above horizontal line or zero of pressure, draw at the admission end o a vertical line a distance representing the whole clearance of t cylinder, as in methods 2 and 4. This will be the zero of vol

* Paper read by Mr. J. Jennings Campbell before the Liverpool Engineering Society.

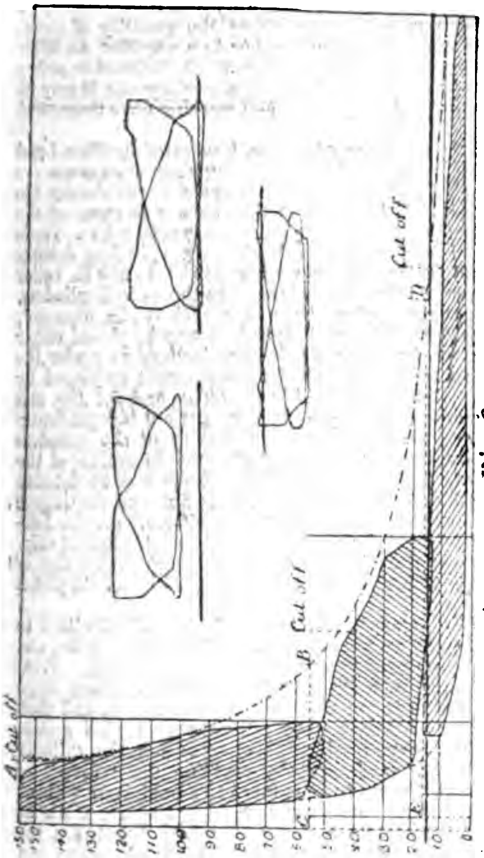


Fig. 6.

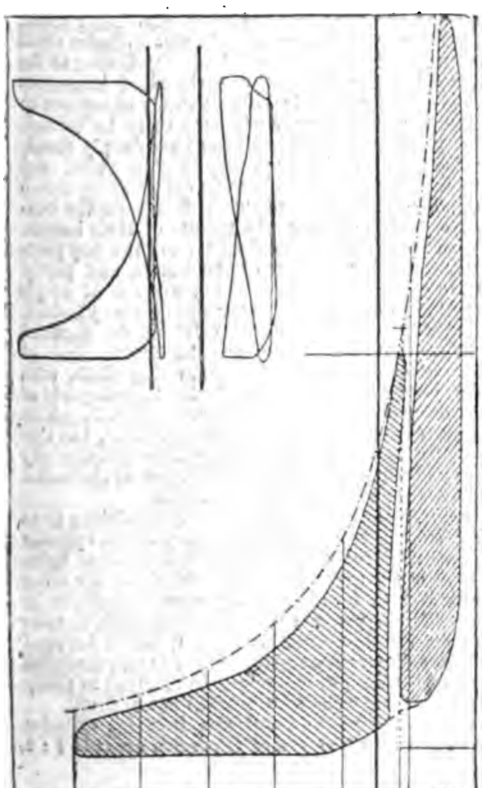


Fig. 5

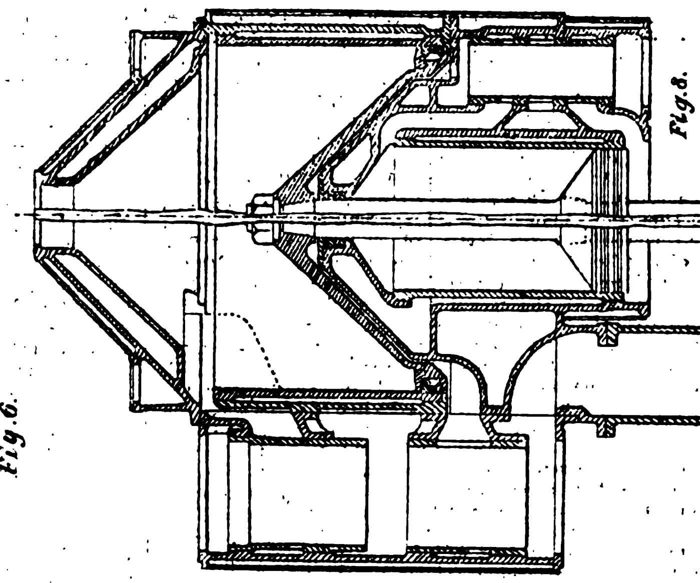


Fig. 8.

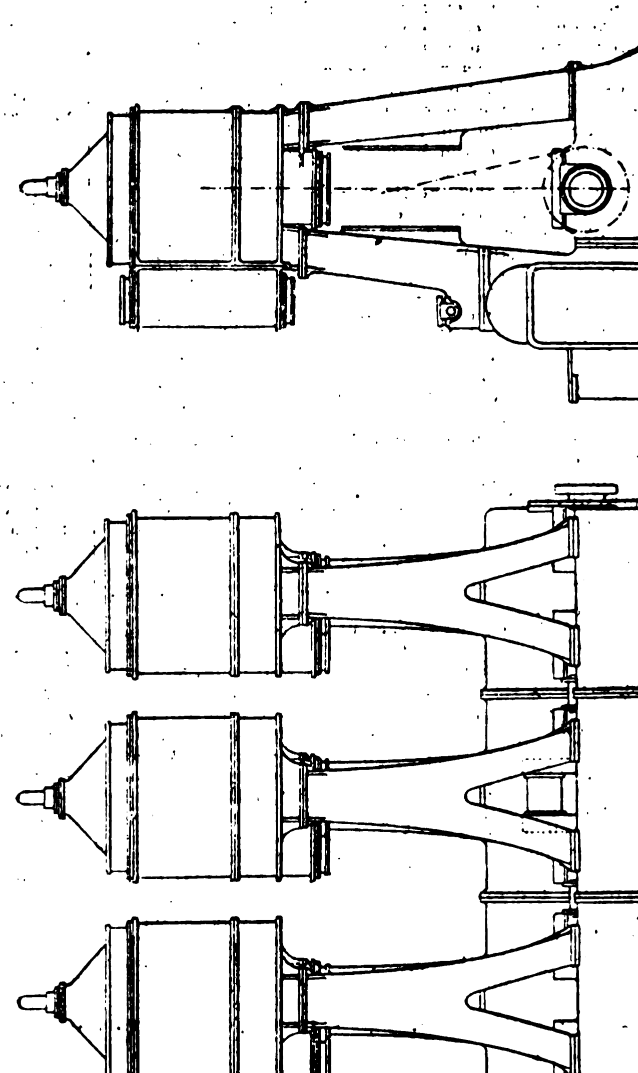


Fig. 7.

ON COMPOUND ENGINES FOR ATLANTIC STEAMERS. (For Description see page 192.)

for that figure, and need not extend down to the vacuum line, but may stop at a pressure = initial pressure in the next cylinder. Having measured the quantity of steam shown at both ends of the expansion curve of the high-pressure figure, *i.e.*, just after cut-off and just before release, take the point in the curve where the product of pressure and volume is greatest, and through that point draw the theoretical expansion curve for the high-pressure diagram. This will rise to the initial pressure of the high-pressure cylinder and be carried down as low as the initial pressure of the next cylinder. At this pressure draw a horizontal line across the diagram meeting the high-pressure zero line of volume at one end and the expansion curve at the other. Now produce the high-pressure compression curve downwards to meet this line. The portion of this horizontal line between its intersection with the expansion and compression curves will represent the equivalent volume of steam at the initial pressure of second cylinder discharged from the high pressure cylinder. If we had drawn a similar horizontal line at the terminal pressure of the high-pressure cylinder, *i.e.*, through the intersection of the expansion curve with a vertical line at the exhaust end of high-pressure diagram, the whole length of that line between the zero line of volume and the expansion curve would give the whole volume of steam contained in the cylinder and clearance at the end of the stroke, the portion cut off between the zero line and the compression curve would give the volume of steam shut up into the cylinder by compression at terminal pressure, and the portion between the compression and expansion curves will give the volume at terminal pressure actually discharged from that cylinder, and this volume will correspond with the increased volume at the initial pressure of the next cylinder already shown on the horizontal line at that pressure. This increased volume ought also to be the volume of steam admitted to the second cylinder—if no loss of steam take place between the cylinders—and is, at any rate, the maximum volume that can be admitted to it, and therefore the theoretical volume which will expand in it. Now, the volume of steam at this pressure admitted to the second cylinder equals the space swept by the piston before cut-off *plus* the portion of clearance unfilled by compression in that cylinder. Therefore, if we measure off from the intersection of the high-pressure compression curve with the horizontal line a distance = the unfilled clearance of the second cylinder, we get the commencement of the second diagram and the volume swept through by the piston before cut-off. (In order to get the unfilled clearance, it is only necessary to produce the compression line of second cylinder up to the initial pressure.) Next, from the point marking the commencement of this second diagram, measure back towards the zero line a distance = the whole clearance in the second cylinder and drop a vertical line; this line will then evidently be the zero of volume for the second diagram. This will seldom be a continuation of the zero line of high-pressure diagram. The length of the horozontal line at initial pressure of second cylinder between this new zero of volume and the intersection with the high-pressure expansion curve, will be the volume we ought to have for expansion in the second cylinder, and the expansion curve for that cylinder will correspond with this volume, and will start from the point where the high-pressure curve stopped. This second curve will fall lower or rise higher than a continuation of the high-pressure curve, according as the new zero of volume is inside or outside the high-pressure zero line. If the engines whose diagrams are being combined are triple-expansion, the same process repeated will give the position, zero of volume, and theoretical expansion curve for the third cylinder.

The diagram thus obtained enables us to compare the pressure at any point in the expansion curve of any of the figures with the theoretical pressure which ought to exist at that point, and will enable us to detect the loss and the best way of remedying it. But it does not give us a standard area to compare with the actual areas of our cards. This should be an area representing the volume of steam at the initial pressure in high-pressure cylinder expanded into a cylinder the size of the low-pressure. To get this Mr. Schöheyder says:—Draw a perdendicular at the admission end of low-pressure figure, rising up to the initial pressure in the high-pressure cylinder, and mark off from it horizontally a distance equal the volume of steam at that pressure admitted to the high-pressure cylinder, *i.e.*, the distance between the high-pressure compression and expansion curves if produced up to that pressure. From the point thus obtained draw a theoretical curve extending out to the end of the low-pressure diagram. The area contained between this curve, the vertical line and the vacuum line will be the standard area, and will represent the work done by the quantity of steam actually admitted to the engines expanded into one cylinder equal the low-pressure cylinder of the compound engine.

This method of treating combined diagrams shows the effects produced by compression in regulating the quantity of steam passed on from one cylinder to another in a way that no other diagram I have seen does. And if any difficulty is found in seeing the correctness of the placing of the different diagrams it may be removed by taking fixed proportions and working out a theoretical diagram.

I shall now describe a type of engine, illustrated by Figs. 7 and 8, which I should recommend for large single screw steamers for the Atlantic mail service, and which I spoke about during the discussion on Mr. John's paper at the summer meeting of the Institute of Naval Architects last year, already referred to. These are quadruple expansion engines having six cylinders driving three cranks, and are intended to work at 180 lb. to 200 lb. boiler pressure. As shown in these figures there are three small cylinders, each 42 in. diameter, and three large ones, each 100 in. diameter, and the stroke is 5 ft. The small cylinders may be placed either above or below the large ones, but I am inclined to prefer the latter, adopting a modification of the arrangement employed by Messrs. Maudslay, Sons, and Field in the *Sirius*, and the *Iris*, and *Mercury*, as it allows of both pistons being got out independently of each other, and keeps the centre of gravity of the cylinders lower. Fig. 7 shows a front and end elevation in outline of the general design of the engines, and Fig. 8 shows a more detailed view of the cylinders in section. This is not one continuous section through the two cylinders but two half-sections, the left-hand half being a section at right angles to the centre line of ship, the right-hand one a section more nearly in the centre line of engines and ship. These two views show the position of the piston valve seatings.

The action of the steam is as follows:—It is first admitted to one of the small cylinders for about six-tenths of the stroke, and from this cylinder it passes into the two other small ones. From these it is delivered into the middle one of the three large cylinders, from which it expands into the other two, and then passes on to the condensers. The advantages of this system are (1) That with a large total range of expansion the cylinder ratio at each stage is small, thereby enabling the "drop" of pressure between the stages to be reduced to a minimum without an inconveniently early cut-off in any of the cylinders, while at the same time, by accepting a moderate "drop" between the second and third stages, a very equal distribution of powers can be obtained on the three cranks. At the same time, the cut-off in the first cylinder being moderately late allows of some considerable variation of power by cutting off earlier in that cylinder. (2) That the expansion in the first cylinder being small, and the ratio between this and the next two cylinders also being small, we can keep the difference of temperatures in this cylinder small also, and thus reduce the initial condensation. (3) Owing to the three small cylinders being of one size, and the three large ones also of one size, the engine ought to be a tolerably cheap one to make, and only two sets of spare gear will require to be carried. The large cylinder bottoms, pistons, and covers are deeply coned, thereby letting the small cylinders partly within them, and making the arrangement compact. The large cylinders have each two piston valves placed at the back of the engines over the condensers, these valves taking steam in the middle of their length, and exhausting over the ends. The exhaust from the top ports passes down partly through the body of the valves, and partly through a passage cast between them. The ports are of ample area, and are arranged to draw all the water out of the cylinders. The small cylinders have each one piston valve on the forward side of the cylinder, but not quite on the centre line of engines, in order to shorten the levers connecting them with the large cylinder valves. I have not made the bottom ports of these cylinders to drain out the water, as it necessitated such an inequality of clearances at the two ends of the cylinders, but this can be done if desired. I have not had time to arrange any particular form of valve gear, but it should be one of the radial or single-excentric types now becoming so common.

In two of the engines the small valves are simply driven from the large ones, but in the engine with the high-pressure cylinder means should be adopted for working the high-pressure valve separately so as to alter the expansion independently of the other cylinders. I think it best for the high-pressure cylinder to be tandem with one of the low-pressure cylinders, as it tends to more equality of power on the three cranks, and if it be the forward one it will give a more direct steam pipe. Fig. 7 is only intended as a general sketch of the design, and might be modified in many particulars when the engines came to be worked out in detail.

It will be seen from the above description that the cylinder ratios at the second and fourth stages of expansion are only 1 : 2

while at the third it is 1 : 3, each small cylinder being one-sixth the capacity of each large one, but two small cylinders delivering into one. It will be found that with a cut-off at about ·6 stroke in high-pressure cylinder and at from ·35 to ·4 in the others very equal powers will be obtained with moderate initial strains on the working parts, especially if the effects of inertia are taken into account. The rest of the engine needs no special description, and any further information that may be required can be elicited by the discussion.

Having now strung together some of my ideas on the subject of compound marine engines especially as applied to the Atlantic mail service, I shall leave the matter in the hands of my hearers for discussion.

NEW DOCK AT CARDIFF.

On August 27th the Earl of Dumfries, the youthful son and heir of the Marquis of Bute, performed the ceremony of opening the Roath Dock at Cardiff, which has been constructed at a cost of £600,000, and adds upwards of 33 acres to the vast dock area of this great coaling port. Cardiff now has a dock area of about 120 acres, and occupies the proud position of first port in the world for the shipment of coal. Its foreign shipments alone (excluding bunkers) being thus in the following years:—In the year 1840, 3,312 tons; in the year 1860, 1,142,366 tons; in the year 1880, 4,997,450 tons; increasing in the year 1885 to 7,132,133 tons coal shipments (coastwise and foreign), exclusive of bunker coal. For the half-year ending June 29th, 1887, the coal shipments were—from Cardiff, 4,393,305 tons; from the Tyne ports—North Shields, 95,107 tons; South Shields, 308,414 tons; Newcastle, 2,738,198 tons—total, 3,141,719. Cardiff ranks as third port in the United Kingdom for shipping cleared in 1886, the clearances being as follows:—Liverpool, 7,530,596 tons register; London, 6,980,716 tons register; Cardiff, 5,106,453 tons register. Newport cleared only 2,124,425 tons register; Swansea, 1,323,198 tons register; Bristol, 1,271,647 tons register; and Gloucester, 415,745 tons register. It will thus be seen that the shipping of the whole of the Bristol Channel ports added together only equal that of Cardiff. Cardiff may be said to be, from its excellent telegraphic and maritime position, not only the most conveniently situated port in the Bristol Channel for the shipment of the celebrated Welsh steam coal, but, in addition, the natural port for the great midland district, having direct and competitive railway communication from the ships' side at the Bute Docks with the London and North-Western, Great Western, and Midland Railways to all the leading centres of commerce.

The contract for the construction of the new dock was, after receiving several tenders, let to Messrs. T. Nelson & Co., of Carlisle, in the latter end of 1882. The first sod was cut by the Marquis of Bute on the 31st of January, 1883, amid great rejoicings. In the construction of this magnificent dock over 2,000,000 cubic yards of masonry have been built. The walls of the dock are 24ft. thick at the bottom, and 12ft. 6in. at the top, and 50ft. 16in. from foundations to coping in height. The height from the sill to the coping is 43ft. 6in. The height of water over the sill is 36ft. at high water ordinary spring tides, and 26ft. at ordinary neap tides. The masonry has been built of the best stone of the upper pennant rock and has been set in Aberthaw pebble lime mortar. The area of the dock, excluding the lock, is 33 acres, and the length of quay space, including the jetty, is 7,520 lineal feet, or nearly a mile and a half. The area of quay space for the storing of cargoes and the general carrying on of the trade of the docks is over 60 acres, and the capacity of the dock is equal to an additional trade of over 5,000,000 tons per annum. The lock is 600ft. long between the gates, and is fitted with three pairs of wrought iron gates, constructed by Messrs. Sir W. G. Armstrong, Mitchell & Co., of Newcastle-on-Tyne, from designs furnished by the engineer. One leaf of each pair of gates weighs 150 tons, so that the three gates weigh 900 tons. They are on the buoyant principle, and provision is made for their not being lifted out of place. The gates are worked by hydraulic machinery made by Messrs. Tannett, Walker & Co., of Leeds, which combines all the latest improvements. The swing bridge across the lock, which has been designed to carry the heaviest traffic, was also constructed by Messrs. Sir W. G. Armstrong, Mitchell & Co. Four hydraulic capstans have been erected by Messrs. Tannett, Walker & Co., one on each pierhead, for more expeditiously handling vessels. The sluice machinery was made by the same firm. A further addition to the accommodation of the dock, namely, a jetty 800ft. long—was let to Messrs. T. Nelson and Co., in August, 1886. This provides an additional quay space of 1,600 ft., and consist of masonry piers with brick arches upon which transit warehouses are about being erected, fitted with travelling hydraulic cranes and railways in connection with the several railway systems around the docks. The accommodation afforded to the trade will be most complete, and all the railway companies in the district will have direct access to the dock, railway quays, and sidings. The north side of the dock and the jetty will be devoted to the import trade, the east and south-east portions to the timber trade, and the south quays will be used for coaling purposes. A large corrugated iron shed has been erected on the north side of the dock for use as an esparto grass shed, which will accommodate 6,000 tons. Moveable hydraulic cranes have been erected on the north side for iron ore and other import purposes, partly supplied by Messrs. Sir W. G. Armstrong, Mitchell & Co., and partly by Messrs. Tannett, Walker & Co. Coaling cranes have also been erected on the south side by Messrs. Tannett, Walker & Co., for the shipment of coal by Messrs. Lewis & Hunter's patent machinery.

Much thought, anxiety, and care have been devoted towards obtaining the greatest possible despatch at the new dock. Sir William Thomas Lewis, the manager of the Bute Docks and Bute Estate, and Mr. Charles L. Hunter, mechanical engineer of the company, have invented a system of hydraulic machinery and contrivances for shipping and discharging cargo that will prove at once a new departure and a decided gain over existing staiths and cranes and appurtenances. For shipping coal, which is the great article of export at Cardiff, the inventors have arranged that the coal waggon shall be run on to a tip-up machine on the level of the quay, where it is made to empty its contents into a box or hopper placed in a pit or subway under the track, running parallel with the quay, and capable of holding an entire waggon load of coal. A cleverly contrived shoot is used in discharging the coal into the hopper, whereby the fall and consequent breakage are reduced to the lowest possible point. By the process, simultaneously with the emptying into the box, the coal is screened, and the "small" falls into a pit placed upon the rails on the sunken way, the pit to be hauled up and discharged instantaneously into waggons and the "small" taken away as required. The box or hopper referred to, into which the coal has been placed, is lifted up by hydraulic cranes fixed upon a moveable frame which spans the double lines of the permanent way round the dock, lowered into the ship's skin, or discharged close to the ship's skin, or just upon the cargo, as the case may be. The coal is discharged through the cone-shaped bottom of the hopper, and breakage is thus avoided.

One or more cranes may be used simultaneously in each hatchway, so that a vessel can be loaded in very much less time than by any contrivance at present in use. For this purpose turntables, tip-up machines, and pits are provided at distances of 100 ft. apart along the quay walls, each with railway sidings for loaded and empty wagons leading to and from the turntables. At present there are two of these travelling cranes, together with six tip-up machines. These cranes are, it is said, the most powerful travelling hydraulic cranes yet made of the kind, and are constructed by Messrs. Tannett, Walker & Co. The cranes are constructed for a working load of 16 tons, through a lift of 60 ft., at a hydraulic pressure of 700 lb. per square inch. The maximum radius of the jib is 40 ft. and the height from the quay wall to the sheaves at that point is over 50 ft., and is arranged so as to swing a portion only or, when needed, a complete circle in either direction. The pedestal or movable frame of the cranes is made to span two lines of railway to facilitate the discharging or loading of vessels to or from railway trucks placed on these lines. These lines run parallel with the dock, and the arrangements are such as to enable cargoes to be loaded simultaneously with the unloading of the same vessels if desired, and for this purpose an hydraulic ram and cylinder are attached to the jib of the crane for working lighter loads of two tons and under. It will thus be seen that this system of discharging and loading vessels is available for either coal or the export and import of other commodities than coal, and the quay space can thus always be utilized for one or more purposes, which will be a great saving to the dockowners, as well as facilitating shipments and unshipments and the despatch of vessels.

The opening ceremony of the Roath Dock was performed amid the greatest enthusiasm. Lord and Lady Bute and their children, the Earl of Dumfries, Lord Ninian Stuart and the Lady Margaret arrived at the dockside about half-past ten in a special train provided by the Rhymney Railway Company. They were accompanied by Lord Edmund Talbot, the Hon. Dudley Ryder,

Mr. Frederick Pitman, Bishop Hedley, and the managing director of the Bute Dock Company, Sir W. T. Lewis. The Mayor (Sir Morgan Morgan), the Town Clerk, and the Corporation, were already assembled on the spot, among others present being Mr. Maclean, M.P., Mr. W. Abraham, M.P., and Mr. Dalrymple, M.P. In opening the dock the young Earl of Dumfries, a child about seven years of age, moved a silver lever, which worked hydraulic machinery, causing the dock gates to slowly open, and thereupon the steamer *Ninian Stuart* sailed in, she being the first vessel to enter the new dock. At this stage of the proceedings cannon were fired, rockets were sent up, and the people gave vent to cheer after cheer.

After witnessing a procession of the pilot boats, Lord Bute entertained about 1,000 guests to luncheon in the Drill Hall. Among those present were the High-Sheriff of Glamorgan (Mr. Tudor Crawshay), the Mayor (Sir Morgan Morgan), Mr. Lewis Morris, Sir John Jones Jenkins, Sir W. T. Lewis, Sir George Elliot, M.P., and Sir Edward Reed, M.P. The Marquis, in the course of the toast, spoke of the rise and progress of Cardiff, and congratulated the inhabitants upon its present position. Subsequently the Marchioness of Bute cut the first sod of a new park of about 100 acres, which Lord Bute has recently presented to the town. The day being observed as a general holiday, the streets were crowded to excess, and unfortunately at the ceremony at the park a scene of discreditable rowdyism occurred. The municipal authorities had provided the necessary barriers to prevent undue crushing, but the mob broke these down, and owing to the inadequate police provisions the sod cutting proceedings were very seriously interfered with.

In the evening the Mayor entertained a large company at a ball.

FORCED DRAUGHT.

THIS subject, which is now seriously engaging the attention of marine engineers, was made the subject of discussion at the recent meeting of the Institute of Naval Architects, at Newcastle. Up till that meeting the question had only been looked at from two points of view—the economy of fuel, and the greater efficiency of the boiler. Mr. McFarlane Gray showed that the subject also had another aspect. In a very humoursome speech he declared that the introduction of forced draught would raise the moral and religious tone of engineers and firemen, as steam would be kept up without any of the very hard work and strong language being used that are now required when the fires will not burn for want of draught. It may also be mentioned that with forced draught the firemen will not be exposed to rheumatism and kindred complaints, the seeds of which are generally laid when the men stand beneath the air shoots to get cool after an exposure to the fires.

A forced draught in the furnaces can be generated in two ways: first, by exhausting the uptakes and funnels of the products of combustion, when a greater flow of air will necessarily take place through the fire bars; and secondly, by increasing the pressure of the air in the furnaces beyond that of the atmosphere. The steam blast in marine boilers is well known to engineers as a means of quickly getting up the steam after its pressure had dropped; but the locomotives on our railways afford a very good illustration of how boilers may be continuously worked under forced combustion through a jet of steam exhausting the smoke-box and funnel of the products of combustion. This system of creating a draught involves a very large expenditure of steam and water; and as it is a *sine quâ non* in these days of high pressure, that only fresh water should be used in boilers, and also as only a limited supply of this element can be carried in a ship, it follows that the plan of inducing a forced draught by means of a steam jet in the funnel cannot be well adopted in marine boilers. Mr. Martin, the inventor of the well-known furnace doors, substitutes a fan in the uptake for the steam jet, and so arranges his funnel that in the event of the forced draught not being required, the gases of combustion arising from natural draught will not be impeded in their exit to the atmosphere. He claims for his invention that it does away with all necessity for closing in the stokeholds or furnaces, and that in war ships funnels could be dispensed with, as the gases and smoke could be discharged anywhere from the fans. He also claims that by his plan of producing a draught, the boiler tubes become much more efficient as heating surfaces, and that the ends of the tubes in the fire-box are not so liable to be burnt away, and that therefore there will be less chance of the boiler leaking round the tubes. There appears to be some grounds for these latter assumptions, for it is a well-known fact that the tubes of locomotive boilers, which are worked as we have seen on the exhaust principle do very much more work than those of marine boilers before they are ferruled or rolled. It can also be shown by a very simple experiment that when the gases are sucked or drawn through the tubes, the flame extends a much greater distance along the tube than when the gases are driven through the tubes. In this latter case the flame impinges on the tube plates before separating into tongues and entering the tubes; but when sucked through the tongues of flame commence at some little distance from the plate before penetrating the tubes, and the ends are not therefore burnt as when the flame impinges directly on them. It may be urged, however, against Martin's system, that owing to the greatly increased volume of the products of combustion due to their temperature, fans of from three to four times the size of those used in other systems are required; also, that the uptakes have to be made larger and heavier to take in the fans; and, lastly, that the fans themselves are likely to be quickly rendered inefficient through working in a temperature of at least 1,000°. These objections prove so formidable that up till the present time Martin's plan of creating a forced draught has made little or no headway.

The other plan for creating an artificial draught in marine furnaces is to force air into them by means of fans. This is done either by closing in the whole of the stokehold and filling it with air of a pressure greater than that of the atmosphere, or by pumping the air direct into the furnace. This latter is the usual practice in the mercantile marine where economy of fuel is sought after. Mr. Howden seeks, by first heating the air and then forcing it by means of fans into the furnaces and ash pits to ensure a very rapid and complete combustion of the coal. His plan has been carried out in the Inman liner *Ohio*, quite recently, and the results as published lead one to expect that with a little more progress in the direction in which he is working, our ships will be driven across the Atlantic without the expenditure of any fuel whatever. The fact of heating the air to a temperature of 200° before it enters the furnace, cannot go very far in affecting either the rapidity or the completeness of the combustion of the fuel, and it certainly cannot affect the economy. Where the fire-grate area is small compared with the total heating surface, good evaporative results are likely to be obtained; and in the *Ohio* the firegrate area was certainly smaller than is usual for the same sized boilers fitted with forced draught. The trip of the *Ohio* to America has given somewhat different results to those of the official trials, and it is question whether any saving in weight, either in the apparatus required to produce forced draught under this system, or in the economy of fuel to be derived from it, has been obtained more than exists in the system of closed stokeholds.

The Ferrando plan of forced draught aims at the utilization of inferior coal for marine purposes, but the prime cost of the apparatus, and the cost of maintenance, outweigh any saving that may be effected in the use of cheap inferior coal as against ordinary coal.

The only plan that seems to hold its own is the closed stokehold system; and the results that have been obtained with it in the Navy are so satisfactory, that Messrs. J. & G. Thomson are about to adopt it in the two large Inman liners they are now building; and also several other firms are about to introduce it in preference to all other plans for increasing the efficiency of their boilers and promoting greater economy. In the Royal Navy, space and weight are of such vital importance, that the boilers have to be constructed on principles the very reverse of those which exist in boilers specially designed for high evaporative work per pound of fuel; and it is not, therefore, to be wondered at that the consumption of fuel per I. H. P. has not been reduced since the introduction of forced draught; but on the other hand, the capabilities of the boilers have been expanded far beyond the expectations of a few years ago. In the mercantile marine, there is no reason whatever why the system of closed stokeholds for creating a forced draught should not combine economy with greater efficiency in the boilers.

In our next paper it is intended to point out the different conditions that are required in the constuction and management of boilers worked under this plan.

ADMIRAL TCHIKHATCHEFF, chief of the Russian Naval Staff, is organizing a plan for transferring the principal administration of Black Sea naval affairs from Nicolaieff to Sebastopol.

TRIAL OF H.M.S. "GALATEA."

On Tuesday, the 9th August, the belted cruiser *Galatea*, of 5,000 tons displacement, and 8,500 H.P., left Govan for the Tail of the Bank, to make a few preliminary trials before proceeding to Chatham. On the following day a lengthened trial at easy steaming was carried out with the object of getting the bearings into good working order; and with the exception of an excentric of the forward engines becoming heated, everything passed off most satisfactorily. The machinery consists of two sets of triple-expansion horizontal direct acting engines; the diameters of the cylinders are 35 in., 51 in., and 77 in. respectively, with a stroke of 3 ft. 8 in.; and it is expected that at full power a speed of 120 revolutions will be easily maintained. All the slide valves are of the piston type, and are actuated by an ingenious system of quadrants, levers, &c., the joint invention of Messrs. Kirk and Brook. The crank shafts are of Whitworths steel, made hollow, having a 7 in. hole running throughout; the diameter of the shaft is 14 in., while that of the crank pin is 15 in. The condensers, which have a collective cooling surface of about 12,000 square feet, are supplied with water by two horizontal circulating pumps in each engine room, and constructed on Messrs. Napier's usual plan. Each of these pumps is capable of discharging 500 tons of water an hour from the bilge in case of leak. Steam for the engines is generated in four double-ended boilers 14 ft. 6 in. diameter, and 16 ft. 9 in. long; there are 24 furnaces in all, each being 3 ft. 6 in. in diameter. The propellers are three-bladed, of the Admiralty type, and 14 ft. 6 in. in diameter, set to a mean pitch of 19 ft.

On Friday, the 12th August, the ship proceeded in charge of Staff-commander Penn, and a navigating party from Chatham, to make a series of progressive trials in the Firth of Forth. The machinery was in charge of Mr. Kirk, the senior partner of Messrs. Napier's, and a large number of well-known engineers and other visitors were on board. At the lower speeds everything worked most smoothly, and nothing could exceed the ease and rapidity with which the engines were manipulated. When the boiler rooms were closed down, and the forced draught fans set to work, a plentiful supply of steam was at once generated; and a run at full power on the measured mile was about to be taken, when some brackets on the main frames for supporting the quadrant shafts of the slide gear of the engines broke away, and led to the complete failure of the whole of these set of engines. The speed at this time was 120 revolutions, steam pressure 125, and vacuum 24 inches. The power, taken from a set of cards taken immediately before the accident, was about 9,000, or nearly 500 over the contract. After the engines were stopped, and the full results of the breakdown were seen, it became apparent that a very narrow escape from a large loss of life had occurred; as the gland on the H.P. slide cover was broken to fragments, slide rods doubled up and twisted, large brackets broken off, and the quadrants were broken. It will take at least six weeks to make good defects, when it is expected further trials will be made.

An Odessa correspondent writes:—Two new turret ships are about to be laid down in Cronstadt for the Black Sea. They will be sister ships, in almost all particulars alike. Their displacement will be 8,000 tons. For protection of centre of ship and machinery steel armour 20 in. thick will be used, decreasing to 10 in. towards the keel. The breastwork and turret armour will be 16 in. They will be armed with four 12 in. guns in each turret, and will carry in addition four 9 in. guns, eight Gatlings, and a torpedo apparatus.

Some important orders in marine material are in course of execution in Sheffield. The Italian Government are constructing an immense war-ship, the *Sardegna*, of 25,000 H.P. The crank and straight shafting are being made at the River Don Works. There are twelve crank shafts, making 104 ft. of shafting, and two sets of straight shafting. The Inman Company is about to place on the Atlantic route two new liners, which are in course of building by Messrs. J. & G. Thompson, on the Clyde. For these ships the shafting is being made at the same establishment. There are eight shafts—four of 45 ft. long, and four of 42 ft. One of the latter has recently been bored. They are also constructing cranks for the Peninsular and Oriental Company. The Italian Government have also placed with Messrs. Vickers an order for three solid crank shafts.

THE NEWCASTLE - UPON - TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

JUBILEE YEAR, 1887.

(*Continued from page* 166.)

Messrs. Carrick and Wardale of the Redheugh Engine Works, Gateshead-on-Tyne, have a number of their specialities on view, in the West Court, and none of our readers who are unacquainted with their improved single and double-acting steam feed, bilge and ballast vertical direct-acting pumps, should omit paying their stand a visit. Having previously described these specialities of Messrs. Carrick and Wardale a lengthened notice is now unnecessary. Many of our readers have had practical acquaintance with their vertical direct-acting pumps, and are certainly as capable as ourselves in appreciating their important and valuable qualities, but a brief statement of their special features may be of interest. Instead of having ordinary lifting or clack valves, Messrs. Carrick and Wardale's pumps are fitted with automatically worked valves, rendering them specially suitable for boiler feeding, pumping out water-ballast, oil tanks, and other purposes, including the pumping of semi-fluids; and, as already indicated, a very large number have been fitted on board steam vessels. Another important feature of Messrs. Carrick and Wardale's vertical direct-acting donkey pumps is that the valves are so arranged that there is a *minimum* of friction when working against high pressures; and a matter of no little importance is that the valve faces are adjustable. The accessability to the working parts in their vertical direct-acting engine pumps is also noteworthy, and only those who have experience in the breakdown of a donkey pump, attached to a bulkhead, and badly designed, so as to render it impossible to easily carry out a small repair, can fully appreciate the advantage of pumps efficiently constructed. We were specially pleased with our visit to the stand of Messrs. Carrick and Wardale, and the excellent workmanship and material displayed in their vertical direct-acting pumps will be acknowledged by any of our readers who, like ourselves, devote a few minutes to their examination. Amongst the exhibits of the last mentioned firm we also noticed a vertical direct-acting air compressor for forcing acids, &c.

Messrs. J. & G. Joicey & Co., Engineers, Newcastle-on-Tyne, are also among the exhibitors of machinery in motion in the West Court, who show at work several vertical donkey pumps, suitable for boiler feed, bilge and water ballast pumps, &c. As Joicey's patent pump has special features, we have arranged to fully illustrate its construction in the accompanying Figs 1, 2 and 3, which originally appeared in our contemporary "Engineering." Fig. 1 gives an external elevation view of this pump, while Fig. 2 is a cross section through the pump and valve chambers, suction and delivery branches; and Fig. 3 is a vertical section through the pump and valve chambers. In each of the two last-mentioned illustrations, the arrows show the direction of the flow of the water, and our readers will readily perceive that the leading feature of this Joicey's patent donkey pump consists in having a piston valve, which is worked by an eccentric from the crank shaft, instead of the ordinary clack valves. Seagoing engineers know how much trouble is from time to time caused by chips of wood or small substances getting foul of clack valves, and are best able to appreciate the value of a pump which, like the one in question, freely passes not only chips of wood, shavings, and the usual things found in suspension, but also such solid bodies as can be moved by the speed of the water. Wherever Joicey's patent donkey pumps have been fitted on board ship they have given great satisfaction, and it has been found that they experience very little wear and tear, even when worked at a high speed. Owing to the areas of the valve being equal, no heavy strain can come upon any part of the valve gearing, whatever the pressure or head of water the pump is working against. If an ordinary pump works beyond a very moderate speed the blow given to the valve on returning to its seat is so violent that frequent renewals of valves are not uncommon, while in Joicey's patent pump there is no blow with the valve, and there is a regular steady flow of water full bore of pipe, whether working fast or slow. We need scarcely point out to our readers that all the working parts are easy of access. What is of almost equal importance is that all the wearing parts have large areas, and are adjustable. Having carefully examined several

of these pumps exhibited by Messrs. J. & G. Joicey & Co. in the Exhibition, both when stationary and in motion, we have pleasure in stating the material and workmanship is of such a high order as to leave nothing better to be desired.

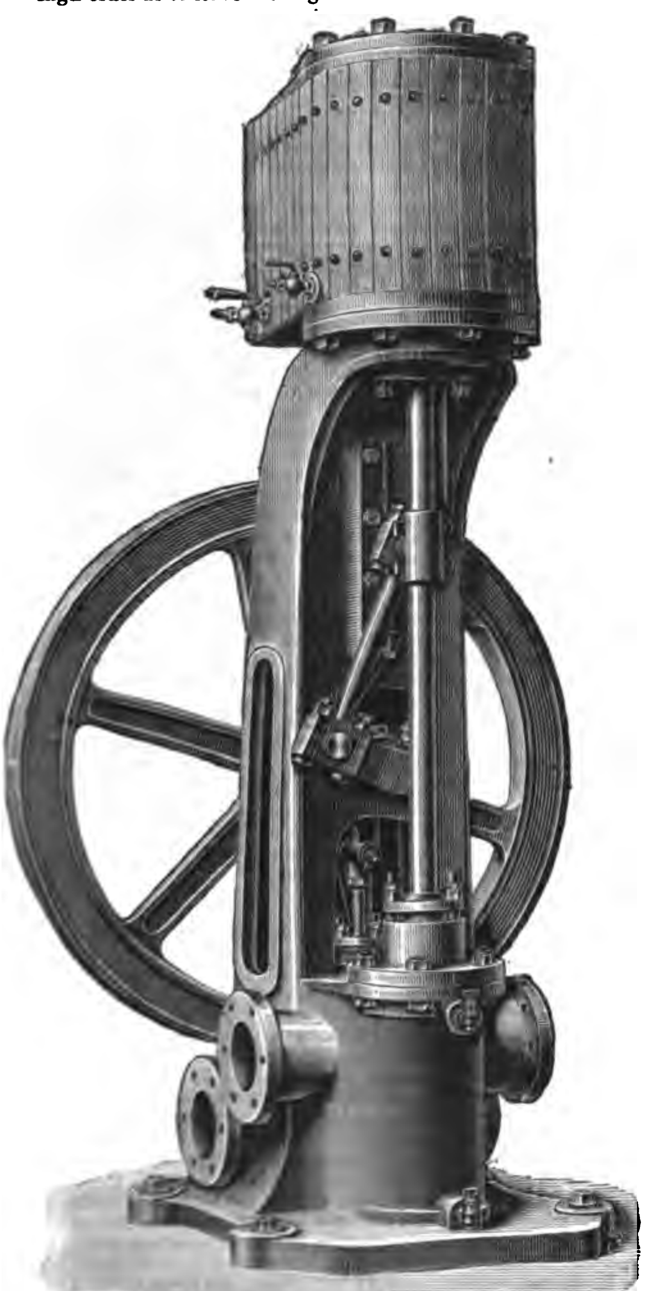


FIG. 1.

The firm also exhibits underground pumps for draining [illegible], &c., in mines, worked by hand or tail ropes. The pumps worked by the latter means are fitted with a specially-designed [illegible] to prevent slip and avoid excessive wear of the ropes. A [illegible] steam valves in cast iron and gun metal, and [illegible] valve with instantaneous coupling, as supplied [illegible] Fire Brigade of the City, and in use exclusively in the [illegible] grounds, should not escape the visitor's attention, as [illegible] give a fair idea of the splendid finish for which Messrs. J. & G. Joicey & Co.'s manufactures are noted. Amongst other [illegible] shewn are specimens of shafting, couplings, pulleys, [illegible], plummer blocks, &c., as well as an interesting collection of drawings and photographs shewing this firm's specialities in tank locomotives, heavy pumping engines, colliery winding and hauling and ventilating fan engines, mill engines, boilers, &c.

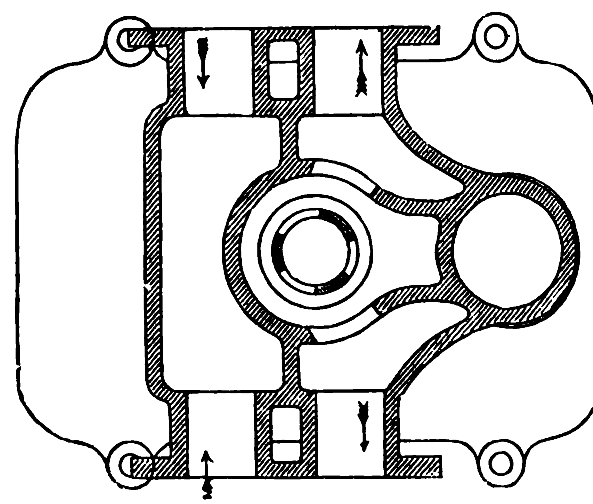


FIG. 2.

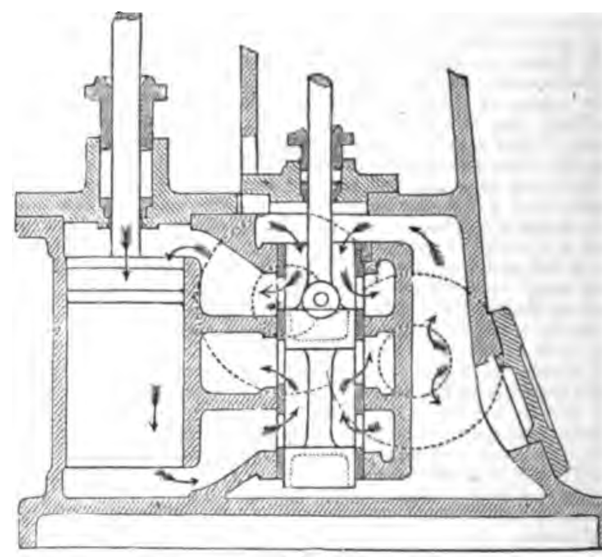


FIG. 3.

Mr. Alexander Allan, The Valley, Scarborough, has several of the latest improved Allan's patent air-spring pressure gauges on view at the Exhibition, both at his stand in the West Court and also on Messrs. T. Toward & Co.'s patent genetic vertical boiler. Having previously described Allan's pressure gauge, we need only remind our readers of its immense superiority over ordinary gauges, owing to its great accuracy, and the absence of any gauge spring liable to become weakened by use. Frequently it is found steam vessels, although supposed to be carrying a full pressure of steam on their boilers, are not giving the speed results they were accustomed to, and how often this is caused by the steam-gauges misleading the engineers, who will say, No doubt the ordinary steam-gauge ought to be frequently tested, but are they? It would certainly be to the advantage of every shipowner to have a gauge as accurate as Allan's air pressure gauge in their steamships, as then there would be no possibility of 5 and 10 lbs. less steam pressure being actually obtained than is indicated by the gauge; and we believe if the Allan's patent air-spring pressure gauge was only more widely known, it would be almost universally adopted. More especially now, when pressures of 150 lbs. per square inch and upwards are becoming common, should the value of this air-spring gauge be realized; and we understand Mr. Allan has, to meet the demand for these specialities, had to make arrangements whereby they can be produced in greater numbers. Those firms who have given these air-pressure gauges a trial invariably report favourably as to

their efficiency. We would strongly urge all interested in the successful management of steam boilers to examine Mr. Allan's exhibits for themselves; and Mr. J. B. Johnson, who represents him, will be glad to explain their properties at Stand No. 517, in the West Court.

Mr. A. G. Mumford, of Calver Street Iron Works, Colchester, has a stand in the West Court, containing a number of exhibits, both in motion and at rest, specially interesting to marine engineers; and besides appearing on the ordinary list of exhibitors, Mr. Mumford contributes to the motive machinery used by the Exhibition authorities. In making a survey of the effectively arranged exhibits of Mr. Mumford, we noticed there were no less than six of his well-known "Favourite" donkey pumps, three of them being single-acting and the remainder of them double-acting. Having previously illustrated and described these pumps, which are claimed to be the cheapest and best in the world, a brief reference must now suffice. Their special features consist in the steam being taken in the centre of the valve-chest, so that the exhaust can be arranged to be from either side of the cylinder, as may be most convenient, while the suction and delivery valves are made interchangeable, the importance of which we need scarcely point out. All working parts liable to friction are of gun metal, and the piston rod is of the same diameter as the ram, in order to diminish the velocity of the up-stroke whilst pumping against a high pressure in the boiler. Not only do the arrangements of the "Favourite" donkey pumps display skilful and careful design—it was also evident, on close inspection, that the workmanship and material was all that could be desired. We also saw the "Colchester" pumping engines at work and at rest. Two of these have been placed at the disposal of the Executive Committee of the Exhibition, and one of them has been in constant use since the Exhibition opened, in pumping the bilges or culverts of the West Court. The action of this pumping engine appears to be perfection, and the man in charge, who is entirely unbiassed, stated it never gave the least trouble. In connection with the steam pipe leading to this engine, we noticed one of Boy's and Cunningham's patent steam separators, for extracting the water from the steam, a most desirable and useful arrangement, especially when every few hours the motive machinery is stopped, and large bodies of steam are condensed in the pipes. The sole licencee of these patent steam separators is Mr. J. C. R. Okes, of 39, Queen Victoria Street, London, E.C.; and the one in use, as well as others exhibited, were manufactured by Mr. A. G. Mumford. Before leaving the "Colchester" engine we may remind our readers it is suitable for all purposes for which pumps are required, but is specially applicable to feeding boilers and pumping water ballast, while it can also be utilised for driving fans for forced draught, &c., in the engine or boiler room. The "Colchester" pumps are made single, double, or quadruple acting, and are very compact; but at the same time all valves and working parts are easily accessible. Both in the "Favourite" and "Colchester" pumps the bearings are adjustable, and in the latter the columns are utilised as air vessels. Amongst the remaining exhibits of Mr. A. G. Mumford we noticed a small donkey engine pump, fitted so as to be worked by hand or steam, suitable for a steam launch, also a number of stop-valves, as well as numerous "Denniss" Patent Full-Way High Pressure Valves, of which Mr. Mumford is the sole manufacturer. While these valves are adapted, and have been used for pressures as high as 1,500 lbs. per square inch, they have also been used as stop valves on marine boilers with great success, their special recommendation being that they are always tight, not only at the beginning but also at the end of a voyage. Pressure on our space prevents our doing justice to the interesting and useful exhibits of this well-known Colchester engineer, but we cannot close our allusion to Mr. A. G. Mumford's stand without noticing a fine specimen of the Patent Eclipse Rock Drill exhibited, as well as samples of spur gear wheels. A small glass show case, containing bolts and nuts in various stages of manufacture, reminds us of the varied character of work which is turned out of the Culver Street Iron Works, Colchester, which reminder is further emphasized by the beautifully finished photographs of marine engines, donkey pumps, and other specialities of Mr. Mumford also on view.

Tuck & Co., Limited, of 42, Chapel Street, Liverpool, and at London, Southampton, Cardiff and Newport, Mon.—works at Lambeth and Cardiff—the world-wide renowned manufacturers of steam packing, leather belting, hose pipes, fire buckets, and multitudinous articles in india-rubber and other materials, have one of the most artistically arranged stands. It is situated in the north promenade of the South Court, and as might be naturally anticipated, attracts almost universal attention. In the centre of the front of the stand the visitor sees a plate glass case containing a variety of specimens of Tuck's flexible metallic asbestos packing, Hocking's patent. In the centre of the case there is shown a Hocking's patent arrangement of the afore-mentioned packing for a spindle of about 3 in. diameter, so that engineering visitors can fully appreciate its advantages. Surrounding the central case are numerous coils of Tuck's triple packing, Morison's patent, as well as a number of coils of india-rubber hose pipes, samples of leather hose, &c. On the right hand side of the front of the stand is a most interesting case, not only to engineering but to all intelligent visitors, as it is illustrative of the manufacturing processes through which the invaluable material asbestos passes, in the works of Tuck & Co., Limited. In the centre is a piece of crude asbestos, showing it in a state of transition from the original rock to the asbestos fibre as used commercially, and besides there are samples of

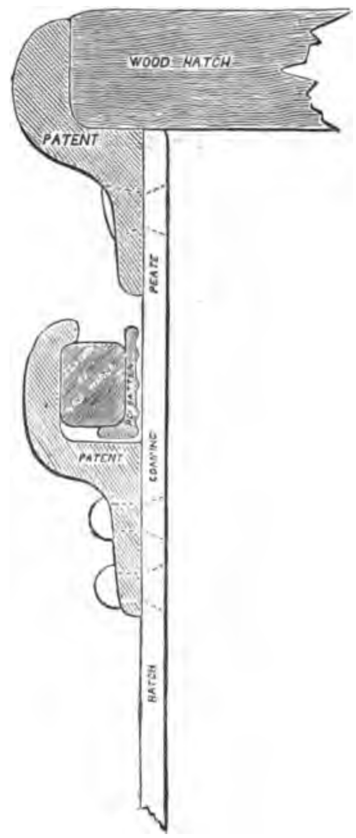


FIG. 1.

asbestos paper and millboard of different qualities, and samples of various kinds of asbestos packing, rubber sheeting, &c. The packing is shown plaited, rolled, square, and round, with and without india-rubber or metal cores. On the left hand side of the front of the stand there is correspondingly placed a case entirely devoted to samples of Tuck's triple packing, Morison's patent, for triple expansion and other high-pressure engines. A careful study of the contents of this case will go far to show to the intelligent engineer the advantage of using this latest production of Tuck & Co. The fine strands of wire, while providing for the necessary elasticity, also ensure the steam-tight qualities for which this triple packing has already become famous. Portions of the outer layers of the asbestos have in several instances been removed from the samples of this packing, exhibited in the case, and a close inspection of them shows the absolute uniformity with which this packing is manufactured, and that all the strands of wire are in every case amply covered with asbestos, so that very considerable wear is provided for before contact of the metals takes place. Innumerable coils of india-rubber piping of small and large diameters, fire buckets, hose conductors, patent hose couplings, leather belting, coils of ordinary flat india-rubber, rolls of india-rubber sheeting, and lengths of Tuck's flexible metallic packing, form

the background of this deservedly respected company's stand, while in the fore-front are displayed several high-class specimens of india-rubber mats; so that, as will be gathered from this all too inadequate description, the stand of Tuck & Co., Limited, both in its details and *tout ensemble*, is well worthy of the attention more especially of those interested in the efficient working of machinery, amongst whom marine engineers are by no means the smallest and least important class.

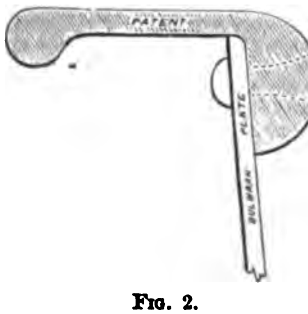


FIG. 2.

FIG. 3.

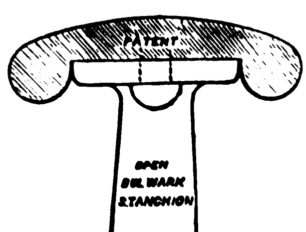


FIG. 4.

In our last number we called attention to the new specialities Messrs. S. Tysack & Co., Sunderland, are manufacturing under Messrs. J. H. Bell's & W. Rockliffe's patents, and have now pleasure in illustrating in Fig. 1 a sectional view of a cargo hatch equipped with their patent moulding, rolled cleats, &c. Having so recently described the advantages of these mouldings and cleats (see August number, pages 164 and 165), a further description is now unnecessary. We understand that at the present time there is on view at the Royal Exchange, Glasgow, a section of a hatch similar to that we now illustrate, and that it has been favourably commented upon by all practical nautical men. In our last number we gave a selection of various sections of bulwark rail iron that have been patented by Messrs. Bell and Rockliffe. Figs. 2, 3, and 4, show modified sections, which are now actually being manufactured, and already large quantities have been rolled. This is only as we anticipated. Owing to the great saving of labour effected in the shipbuilding yard by their use, we felt assured they only required to be known to be appreciated.

Messrs. Hawks, Crawshay & Sons, of the Gateshead Iron Works, Gateshead, have a large number of important exhibits. The most imposing, if not the principal exhibit, is that of the ninety hundredweight Martin's improved patent anchor. The [illegible] Martin anchor are now well-known, comprising as they do strength, simplicity, great holding power with immediate action, and diminished weight. At this exhibition nautical men have a first-class opportunity of considering the various qualities of the different anchors which have been patented, as on the stand of Lloyd's Register of British & Foreign Shipping, there are models of a large number, including Martin's original, as well as the improved anchor. On the stand of Messrs. Hawks, Crawshay and Sons, besides the large improved Martin's patent anchor, there is one weighing half a ton, and a miniature specimen in brass of about two pounds weight, so that the visitor has unusual opportunities of making himself *tout-à-fait* acquainted with the mechanism of this deservedly popular anchor. The principal modification in the improved Martin's patent anchor, on the older type, consists of a simple but effective arrangement of the head, which acts as a lever on the flukes, compelling them to take the ground immediately the strain is applied through the cable. The head is fixed at right angles on the flukes, and moves freely round the end of the shank. The elongation of the head on both sides is peculiarly shaped to act as tipping points, and this part resting on the ground when the anchor is down, the superincumbent weight causes it to bite firmly, whether in hard or soft ground; immediately the strain is applied, the resistance of the ground to the tipping points compels a rotary movement, and turns the flukes into the ground. Great success has attended this improved Martin's patent anchor, and at a series of trials in 1885, by the dockyard authorities at Portsmouth, it was decided that out of a number of different anchors tried, the improved Martin's anchor was the best, on account of its superior holding power, simple construction, and prompt action. Its simplicity will be evident when we state that the anchor is weldless, the flukes are composed of one solid forging and the shank of another, while the severe strains due to mooring are entirely confined to these two solid forgings, without the intervention of bolts, pins, keys, cotters, &c. This improved Martin's anchor is an advance to the original Martin anchor, which, when too little cable was payed out, or a want of care exercised in paticular anchorages, &c., did not act as quickly and efficiently as was desirable; and it is not, therefore, surprising to learn that our Admiralty authorities are converting some of their original Martin anchors into the improved pattern, and that a large number of important orders have been received for the improved Martin anchor from the British and Foreign governments and leading mercantile shipowning companies. We cannot speak too highly of the workmanship displayed in the specimen anchors exhibited by the manufacturers, Messrs. Hawks, Crawshay & Sons, who have long been one of the foremost firms in this country. This firm amongst their exhibits show some of the account and letter books which date back as far as 1747, and are full of interest, as they furnish records of Tyneside industries of that date. A model of the Tyne high-level bridge should not be overlooked, which, it will be remembered was designed by Mr. Robert Stephenson and erected by Messrs. Hawks, Crawshay & Sons, for the North Eastern Railway Company, across the River Tyne, from Gateshead to Newcastle. The bridge consists of six cast iron arches, supported upon solid masonry piers; its length being 1,337 ft. and its height above high water mark, 112 ft. The cost of this famous structure was nearly £500,000. Messrs. Hawkes, Crawshay & Sons are still largely engaged in bridge building, both in iron and steel, having at present in hand 213 bridges for the Japanese and Italian Governments, of which the spans range in length up to 200 ft. This firm is also largely engaged in engineering, marine, stationary, pumping, &c., and are at present completing a large pair of rolling mill engines for the Consett Iron Company, of which the main shaft is 26½ in. in diameter. Among the many interesting exhibits of Messrs. Hawks, Crawshay & Sons, we also observed large models worked by hydraulic pressure of Messrs. Bruce & Bath's patent hydraulic dredgers, both as originally designed and improved, of which Messrs. Hawks, Crawshay & Sons are the sole manufacturers; the action of which is well-known. This Gateshead firm is renowned as anchor, and chain cable manufacturers, and as might be anticipated, many of their exhibits are illustrative of chain manufacture. Hitherto Messrs. Hawks, Crawshay & Sons have confined themselves to iron manufacturing, but they are now embarking in the manufacture of steel. For this latter purpose they are utilizing their high rolling mills at Gateshead, which have been idle for some months. It is intended to adapt these works for the Siemens-Martin process, and it is anticipated that in less than a year this firm will be competing in the open market for the making and supplying of ship and boiler steel plates, angles, &c. Among the exhibits of chain cables we particularly noticed a 3½ in. and 3¼ in. mooring chain, which have been tested at Lloyd's machine to 250 tons, also a 2½ in. stud-link

chain cable, which on testing did not break until a strain of 190 tons was applied, being 69·7 per cent. above the Admiralty requirements; as well as a 1¾ in. common link chain, which only broke with a tensile strain of 63 tons, equal to 178 per cent. above the Admiralty proof strain.

As we walked under the partially weather protected lean-to in the North Gardens, our attention was attracted by one out of many exhibits of Messrs. John Dove & Co., of 35, Close, Newcastle-on-Tyne, whose stand is opposite to the end of the old Tyne Bridge. We refer to a sample of Mr. E. F. Wailes' patent composite deck covering, which it is proposed should be used for the protection of iron and wood decks, more especially before they have been worn so thin as to require, by the rules of Lloyd's Register of Shipping, to be renewed. In comparison with the relaying of decks this covering is stated to be of nominal cost, and among other advantages claimed for it are—that it dispenses with the re-caulking of wood decks, the scaling and re-painting of iron decks, and also renders unnecessray the sheathing with wood of decks where there is much traffic, as in cattle and passenger steamships. Excessive heat or accumulated water is not injurious to this covering, which is said to be impervious to moisture, watertight, non-combustible, and, while affording a sure foothold for all traffic, is specially prepared to withstand the working, straining, or vibration of the vessel, as well as the variations in climate to which sea-going vessels are exposed. It is equally suited for 'tween decks as for weather decks, and averages about ⅜ in. in thickness, weighing about 4 lbs. per superficial foot. To the eye it presents a smooth, dark surface, and its durability is said to be such, as it will last the average life of a ship with but slight repairs. The sole proprietors, Messrs. Wailes, Dove & Co., of 35, Close, Newcastle-on-Tyne, are prepared to apply this deck covering at any port in the United Kingdom, the time required to cover an entire deck being from four to five days. We understand it is being fitted to several vessels and a large pontoon on the Tyne.

We have already incidentally noticed some of the exhibitors whose stands are in the West Court, but there still remains a number whose exhibits are deserving of notice.

On entering the West Court from the south end, along the east wall, we notice a design of Messrs. Menzies & Blagburn, of Newcastle, for a steamer to carry 1,000 tons of sewage for the London Metropolitan Board of Works, and also a large collection of photographs of marine and land engines. The latter are exhibited by Messrs. Westgarth, English & Co., engineers, of Middlesbrough, and are representative of some of the engines which have been constructed by this firm. The most recent and important are the triple-expansion marine engines constructed for the screw-steamer *Warrington*, owned by the Manchester, Sheffield and Lincolnshire Railway Company. These engines indicate 1,100 H.P., and the principal sizes are as follows:—High-pressure cylinder, 22 in. diameter; intermediate pressure, 35 in. diameter; and low-pressure cylinder, 57 in. diameter; with a uniform stroke of 3 ft. 6 in. in length.

The Farnley Iron Company, Limited, of Leeds, have a specially interesting collection of exhibits, which none of our readers should omit to inspect if they are visiting the Exhibition. The special feature of this well-known company's stand is the specimen "Farnley" Boiler Flue, the patent of Mr. H. P. Fenby, which has been designed to meet the growing requirements for a furnace suitable to the high pressure of steam becoming so very common in marine boilers. In our fig. 1 we illustrate this new kind of corrugated flue, and at a glance the difference between it and Fox's Corrugated Flue will be seen. Instead of the corrugations

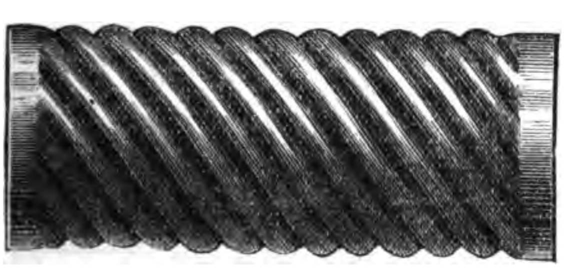


Fig. 1

being parallel to one another they have a rapid spiral direction, and owing to this feature it is claimed that Fenby's Patent Flue has increased longitudinal strength without losing the great advantage of transverse stiffness, the feature common to all corrugated flues. Up to the present time there have been no actua tests of the full-sized flue, such as that exhibited, which is 3 ft. diameter, and of ⅜-in. thickness; but arrangements are being made for a public test in the presence of impartial expert representatives of engineering and boiler-making. In the mean time experiments have been made with smaller copper flues, and, as will be seen from the results furnished to us, the Fenby Flue is decidedly superior longitudinally to any corrugated flue as yet produced, and in no way inferior. With the increasing disposition to use higher pressure of steam, the necessity of providing in the furnace flues efficient staying to the boiler front and tube plate, becomes manifest; and evidently this has been kept in view by Mr. Fenby in designing this latest patent flue for land and marine boilers. Another quality which it is anticipated this flue will have is, that the whirl of the flame caused by the spiral corrugations will be of great assistance to the proper combustion of the gases. The principal claim to this patent flue consists, however, largely in the mode of manufacture, as after the flue is welded it is in one heat put through two sets of rollers running in opposite directions. For the purpose of manufacturing these "Farnley" Boiler Flues, the manufacturers have erected a special rolling mill of large size, according to the designs of Mr. H. P. Fenby, capable of producing these spiral flues from 2 ft. 6 in. to 5 ft. diameter, and up to 10 ft. in length. They are being manufactured either from selected plates of the best Siemen's steel, or from the well-known "Farnley" iron. The details of the experimental tests are as follows:—

Experiments showing the relative strength of three different forms of boiler flues to resist collapse and end compression.

The flues tested were in all cases 6 in. long, 3 in. in diameter, formed of copper, No. 24 B.W.G., with brazed joint. Weight 8 oz. June 18, 1886.

Collapse.

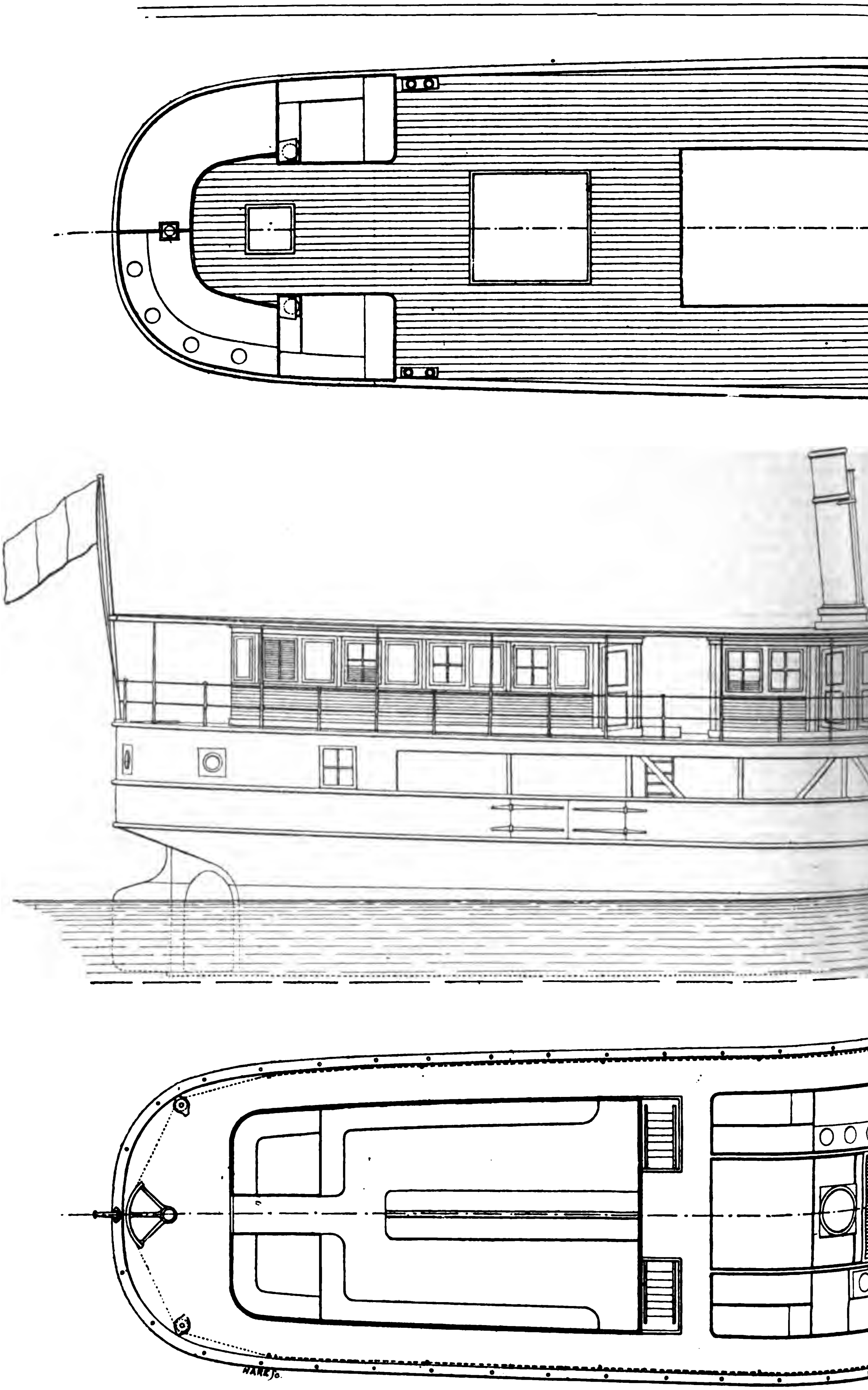
Date of Experiment.	Number of Experiment.	1. Plain.	2. Annular Corrugations.		3. Fenby's Rapid Spiral.	
		Collapsed.	Collapsed.	Extension.	Collapsed.	Contraction
		lb. per sq. in.	lb. per sq. in.	in.	lb. per sq. in.	in.
February 9, 1886	1	38	210	·025	290	·037
	2	38	250	·025	265	·037
	3	..	..	..	220	·025
	Average	38	230	..	258	
	Ratio ..	100	605	..	679	
February 19, 1886	1	34	175	·075	222	·075
	2	36	245	·025	228	·025
	3	..	215	·025	255	·075
	4	..	200	·02	235	·025
	5	..	250	·025	260	·025
	6	..	215	·025	190	·025
	Average	35	216·6	..	231·66	
	Ratio ..	100	618·8	..	651·6	

Note.—All the Fenby flues shortened slightly under external pressure instead of lengthening, thus proving a valuable stay for the boiler ends.

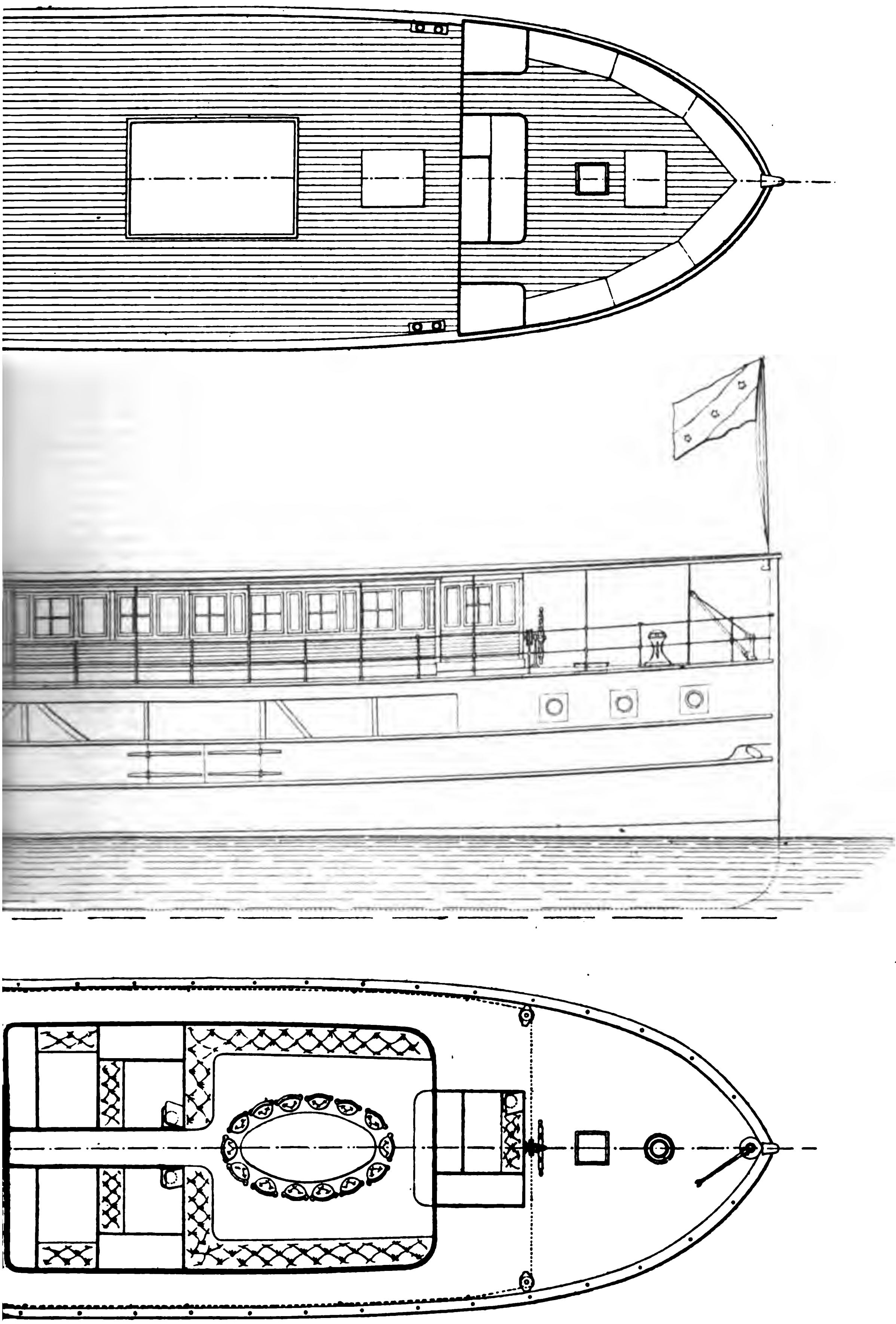
End Compression.

—		Crushed. Pounds Deadweight.	Crushed. Pounds Deadweight.	Crushed. Pounds Deadweight.
February, 1886.	1	2,580	725	1,280
	2	2,785	980	1,210
	3	2,865	1,040	1,160
Average ..	..	2,743⅓	915	1,216·6
Ratio ..	..	100	33	44·3

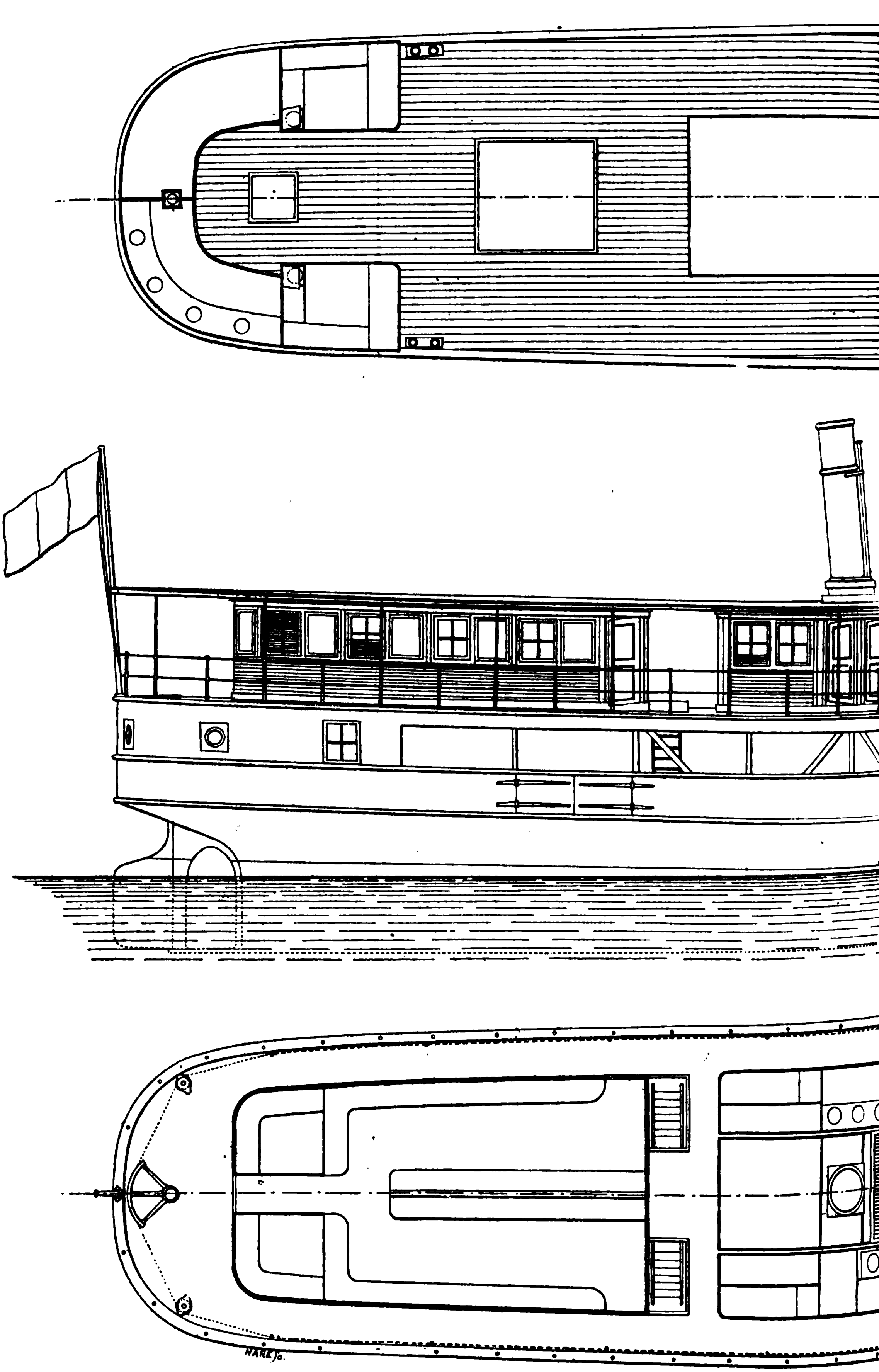
The "Farnley" boiler flue, to which we have drawn attention, is fitted in a specimen "Farnley" flanged boiler front of 9 ft. 6 in. diameter, with three furnace tubes 3 ft. diameter having 6 in. flanges, of which it need scarcely be said the workmanship and material is all that can be desired. A most



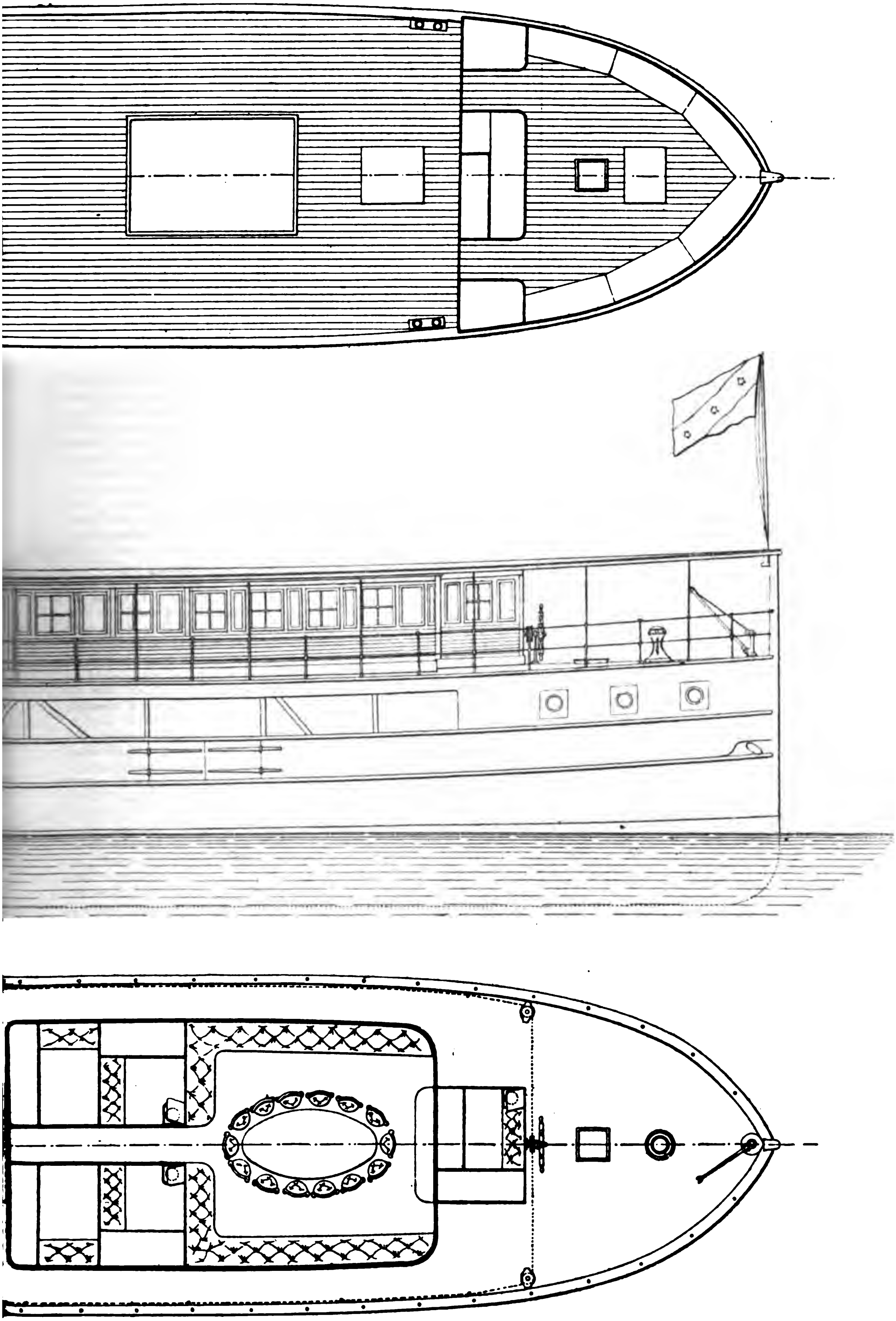
COMPOSITE SCREW STEAMER FOR THE TONKIN RIVER MAIL SERVICE. BUIL



GEO. FENWICK & CO., PRAYA EAST, HONG KONG. (For Description see page 207.)

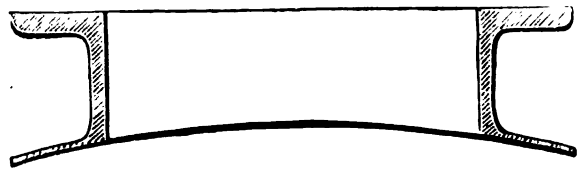


COMPOSITE SCREW STEAMER FOR THE TONKIN RIVER MAIL SERVICE. BUIL



GEO. FENWICK & CO., PRAYA EAST, HONG KONG. (For Description see page 207.)

interesting exhibit is a collapsed flue, taken out of a marine boiler. As this flue is of the Farnley Company's manufacture, and is of their best quality of iron, the reason of its failure was not to be looked for in bad material or workmanship, *au contraire*, this collapsed flue is a forcible example of the superiority of the Farnley Company's manufacture; as the upper portion of this flue came down about half its depth, it is about 3 ft. diameter, without showing the slightest signs of fracture either on the inside or outside of the flue. The cause of the failure is surmised to have been neglect of keeping a sufficient quantity of water in the boiler. In our second illustration of the Farnley Iron Company's exhibits, we show another speciality which they have recently commenced to manufacture—viz., a weldless neck for the dome of a marine boiler, or a weldless iron manhole seat—stamped out under the steam hammer. The advantages of this as a manhole-seat for the top of a boiler will be manifest to all practical men. All the flanges are 5 in. in width, the lower ones being only ½ in. in thickness and the upper ones 1 in.—so



compensating for the larger holes required in bolting down the manhole cover—while the lower flanges are of such a width as to permit of double riveting. A still more interesting exhibit is a dome 2 ft. high, 19 in. diameter, with 4½-in. flanges of Siemens steel plate ½ in. in thickness, which has been formed under the steam hammer out of a plate. To show that the dome is of uniform thickness and has been formed out of one plate as stated, the top of it has been cut out and is shown separately. A somewhat similar specimen of workmanship is that of a melting pot, similar to those supplied to the Sydney Mint, in Australia. They were made of the best Yorkshire iron, as manufactured by the Farnley Company, and the specimen exhibited is 1 ft. 6 in. in depth and internal diameter, with a 3 in. flange all around the top, and is 1½ in. in thickness. There are also at this stand a number of bars 3½ in. square, which have been broken to show the homogenous appearance which the best Yorkshire iron presents, as well as a number of good tests of rivet and other iron, &c.; but what appeared to our mind to be the most convincing proof of the high quality of the Farnley iron was the 7½ in. shaft, which is shown bent double without the least sign of fracture.

Nigh to the small stands to the north of the principal entrance, in the North Court, devoted to the Naval Architectural Exhibits of Palmer's Shipbuilding and Iron Company, Limited, are similar stands occupied by full models, half models, and photographs illustrative of vessels built or designed by Messrs. C. S. Swan and Hunter, of Wallsend-on-Tyne. Four of the models exhibited on this occasion by Messrs. Swan & Hunter we noticed at the Liverpool Exhibition, and drew attention to them at some length in our July, 1886, number, pages 99, 100, and a further detailed description of them will therefore not now be requisite. Two of these models represent proposed steam vessels, respectively for the Atlantic mail service and the channel passenger trade. It is a matter of regret seeing how enterprising the Tyneside shipbuilders have been in designing screw steamers in advance of the actual requirements of the moment for the Atlantic mail and passenger service, that they have not secured the order for at least one of the four large twin-screw steamers building respectively for the White Star and Inman and International Lines. Messrs. Swan & Hunter can at all events congratulate themselves on having perceived on what lines the coming Atlantic greyhounds would be built, at least, so far as the adoption of two propellers in the place of one is concerned. The remaining models of vessels which we saw at Liverpool, are one of the sister screw steamers *Corangamite* and *Burrumbeet*, and the full model of the sailing vessel *Cambria*. The exhibits which have been specially prepared for the Newcastle-on-Tyne Exhibition by Messrs. Swan and Hunter would, however, make a good show, irrespective of the important models, already briefly noticed. Especially is this true of the full-rigged model of the s.s. *Northenden* and s.s. *Warrington*, which were built by this Tyneside firm for the Manchester, Sheffield, and Lincolnshire Railway Company's continental trade for passengers and light cargo between Grimsby and Hamburg. The principal dimensions are:—Length, p.p., 230 ft.; breadth, moulded, 30 ft., and depth to main deck 15 ft. These vessels have a long poop, long bridge house amidships, and topgallant forecastle, and have accommodation for about 30 first-class passengers. The engines are of the triple-expansion type, the cylinders being 21½ in., 33 in., and 57 in. in diameter, 3 ft. 3 in. length of stroke, working at 150 lbs. pressure, and were manufactured by the Wallsend Stepway Company. The *Northenden Warrington* has made the fastest passage on record, from Grimsby to Hamburg in 27 hours 5 minutes from port to port. The model of these vessels is highly finished and will bear close inspection. The model of the *Carmarthenshire* one of the well-known line of tea steamers of Messrs. Jenkins and Co., of London, is another splendid exhibit. This vessel carries about 4,000 tons deadweight and steams at a high rate of speed. The principal dimensions are:—Length, p.p., 330 ft.; breadth, 40 ft.; depth, moulded, 27 ft. 8 in. The *Carmarthenshire* is also fitted with triple-expansion engines, and is the third vessel built by Messrs. Swan & Hunter for the Shire line. The same firm of shipbuilders also exhibit a highly-finished model of the paddle steamer *Horatio*, built by them last year for the mail service in the West Indies, which vessel is fitted with compound paddle engines, and attains a speed of 13½ knots. Numerous photographs of Messrs. C. S. Swan & Hunter's yards, fitting-out berths, &c., and some of the steamers built by them are also exhibited.

Outside the immediate district known as the North-East Coast there are but few British shipbuilders directly represented at the Newcastle-on-Tyne Exhibition, and only one of the Clyde firms who have recently built "crack" steamers have forwarded exhibits, viz., Messrs. Jas. & Geo. Thomson, of Clydebank, Dumbartonshire. Their exhibits consist only of one of the large number of models they exhibited at Liverpool, viz., the full-rigged one of the famous s.s. *America*, built to the order of the National Line Steamship Company, Limited, of Liverpool, and a full completely rigged one of H.M. twin-screw torpedo cruiser, *Scout*, which is here exhibited for the first time. Regarding the model of the *America*, we expatiated at length in our July, 1886, number, page 101, describing it as "undoubtedly one of the best finished in the Liverpool Exhibition," which opinion was endorsed by a gold medal being awarded it by the jurors of that exhibition, and, by the way, a gold medal was awarded for it at the Inventions, 1885, Exhibition. It certainly compares favourably with even recently constructed models of Tyne built war and mercantile steamers, magnificent though they be, and it will ever be remembered, to the credit of the vessel *America*, that she steamed from Liverpool to New York on about 1,300 tons of coal, considerably less than any other Atlantic steamer of similar speed. It is, under those circumstances, an unfortunate *contretemps* that the National Line were not able to make the working of this steamer remunerative, and had to sell her at £49,000 less than the original cost of £180,000—to the Italian Government. Doubtless it was owing to the *America* being suited for a different class of traffic to that hitherto engaged in by the National Line, but it is surprising she was not retained in the hands of English shipowners, or purchased for a cruiser by H.M. Government.

Messrs. John Brown & Co., Limited, of Sheffield, have at their stand in the North Court, and also in the North Gardens, a magnificent and imposing display of exhibits illustrative of the special manufactures for which they have long been famous. Their exhibits of armour-plating are specially interesting as they are illustrative of the advances that have been made in its manufacture. These comprise pieces of iron armour as manufactured for the first armour clads, one piece having been tested with round shot, and another pierced by a Palliser projectile. There are also exhibited specimens of the later type of armour-plating manufactured by Messrs. John Brown & Co., Limited—viz., the compound steel-faced, the patent of Mr. J. D. Ellis, who, along with Mr. Stephen Burridge, is now at the head of this great firm. At the corner of the stand is a large piece of this compound steel-faced armour plate 11 in. in thickness, which shows that the Palliser shot was destroyed at impact, without materially damaging the plate. Another piece, of the same thickness, has been bent to a right angle, and although hard steel-faced, shows such a marvellous combination of tenacity and flexibility in there not being even a surface fracture visible. It may be of interest to some of our readers to learn that the proportions of steel facing in this compound armour is one-third of the total thickness. There is also exhibited a portion of Ellis' patent compound armour of the greatest thickness of plate actually used—viz., 22 in.—and some account of its manufacture may not be without interest. The hard-faced steel is first prepared and a plate is rolled about 5 in. thick. The iron plating for the back of the armour-plating is also separately manufactured, somewhat as follows. At first it is puddled and rolled into one-inch moulds, and again into three-inch moulds. These are then placed in sandwich fashion in a

re-heating furnace, in sufficient quantity to make the back at this stage as thick as the ultimate finished thickness of the armour plating. The iron backing and steel facing are then put on to a strong frame round three sides, with the top open, a four inch cavity being left between the steel and the iron, into which is poured fused steel. After solidifying, the armour plate, which is now 31 in. thick, is re-heated, and gradually reduced in thickness by pressing and rolling down to the finished thickness. The exhibit of Messrs. John Brown & Company, Limited, which will in all probability be most interesting to our readers is their patent ribbed flue. A full sized one, 3 ft. 6 in. diameter over all, and 3 ft. 2 in. effective width of grate, is erected on the stand, projecting into the front of a boiler, having the flanges turned inwards as hitherto customary to receive the ends of the furnaces. This front plate is ⅞ in. thick, and is intended for a marine boiler 16 ft. 6 in. diameter, 8 ft. 6 in. long, and is provided with four furnace holes, and was flanged in one heat by hydraulic pressure. Fig. 1 shows the section of the patent ribbed flue at the point where it is connected to the front plate of boiler; and

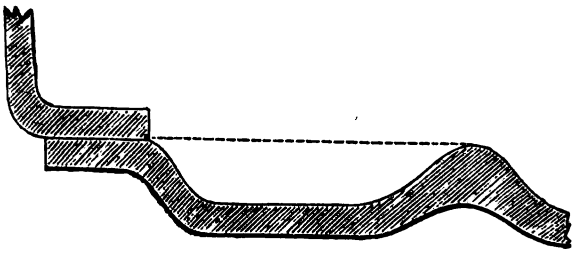


Fig. 1.

Fig. 2.

Fig. 2 shows a portion of the ordinary section of the patent ribbed flue, of which a planed piece is exhibited. The furnace exhibited is 6 ft. 8 in. in length, and is 9.16 in. normal thickness, and has been tested by hydraulic pressure to 780 lbs. per square inch. These patented ribbed flues of Messrs. John Brown & Company, Limited, are intended to combine the advantage of the longitudinal strength of plain flues with the great resistance to collapse under pressure obtained in corrugated flues. As the ribs are formed in the manufacture of the plate itself, there is no necessity, as in the case of corrugated flues, to weld the joint for the purpose of subsequent corrugating, and by this expedient is obviated the straining of the weld, which is unavoidable in the production of other flues. By the shape of the ribbed flue the makers ensure absence of pockets in which the scale can lodge. The many experiments and numerous trials made under the supervision of Lloyd's and the Board of Trade have all been successful, and have shown that, as was anticipated, in addition to being as longitudinally as strong as ordinary flues, they are enormously strong for resisting collapsing. Although these flues have but recently been brought into the market, already large numbers are being put into marine boilers in course of construction in the north-east coast and other districts. A plate for a super-heater, of Siemens-Martin steel, is worthy of close inspection, as it is a splendid piece of workmanship. It is 9 ft. 6 in. diameter over all, and 6 ft. 6 in. internal diameter, has 5-in. flanges, and was flanged in two heats. A large propeller blade, 9 ft. in length, 5 ft. 6 in. width, with 4 ft. diameter of face; has its face turned up, showing it to be absolutely without a flaw, and is the only similar exhibit so shewn. It will be noticed the blade has its width carried nearly parallel to the tip, giving great surface, and has sharp fore and aft edges. It is said to be the same as supplied to the s.s. *America*, and weighs 6¾ tons. Among other exhibits on the stand of Messrs. John Brown & Co., Limited, in the North Court, we noticed two hemispheres for sunken mines, formed to shape in a hydraulic press, showing exceptional material and workmanship; also two chains of links for the new Hammersmith Suspension Bridge, consisting respectively of nine and eight plates each, and weighing about 6 tons, erected as if in position against the tower of the bridge. The links have been rolled into shape with swelled heads, and not forged or machined. For purely rolled work, these links may be well styled unique. Passing by the tyres, springs, wheels, buffers, locomotive cranks, etc., as being of minor interest to our readers, we only pause to glance at Eave's Improved Dead-weight Safety-valve, and at an elaborate showcase in which there is a section of the seams of gas and steam coals at Aldwarke Main and Car House Collieries, near Rotherham, the property of Messrs. John Brown & Co., together with samples (132 in number) of the various residual products obtainable from this gas coal, which yields 12,600 cubic feet of gas per ton. The visitor cannot well overlook a large steel hoop for a chemical furnace, standing upright; and also an immense chemical pan, 9 ft. 4 in. diameter, 2 ft. 4 in. deep, and ⅞ in. thick, made out of a wrought steel plate 10 ft. 8 in. diameter, flanged by hydraulic pressure. We have mentioned that Messrs. John Brown & Co., Limited, have a stand outside in the North Garden. Here, near the Electric Railway, we see they exhibit a plate about 20 ft. long, 10 ft. high, and ⅞ in. in thickness, weighing about 3½ tons. It is of Siemens-Martin steel, such as this company rolls for boiler plates. There is also a large cast steel propeller bracket, 7 tons weight, the only actual exhibit of the kind, other firms only exhibiting patterns of these brackets. There is also a single-link plate of the Hammersmith Bridge. Messrs. Allen & Robson, of 13, Dean Street, Newcastle-on-Tyne, are the Agents of Messrs. John Brown & Co., Limited, who have largely contributed to the securing of the splendid array of exhibits we have just described, and which it will be generally acknowledged is of a high class and exceptional character. They should prove interesting to all ordinary as well as other visitors practically interested in the various industries for which this company caters, which, by the way, includes the makers of oilcake, the manufacture of thrashing machines, &c. Eyre's solid forge steel wheels should not be overlooked; they are specially suited for railway and tramway purposes, being perfectly weldless, forged out of a single steel bloom. The Electric Tram Car in the North Gardens is fitted with Eyre's solid forged steel wheels, of which the sole makers are Messrs. John Brown & Co., Limited, of Sheffield.

Passing over a number of miscellaneous exhibits, we come to those of Messrs. Smith Brothers & Co., of Kingston Engine Works, Kinning Park, Glasgow. This firm are well-known manufacturers of engineers', boilermakers', and shipbuilders' machinery, and in their department their exhibits are among the most important exhibited. When we inform our readers that the aggregate weight of the machines on view is upwards of 40 tons, they will also have some idea of their extensive nature. Amongst the exhibits of Messrs. Smith Brothers & Co., we particularly noticed their portable hydraulic riveting machines, which are made of cast steel, of great strength. One of their specialities in this line is a machine for closing the plates and upsetting the rivets in the ends and flanges of heavy marine boilers—the suspending bracket of which is fitted with worm and worm wheel, so that it may be hung at any required angle. The seven-roller plate straightening machine is not one to be overlooked. It has powerful gear for raising and lowering the top rollers by means of a large hand-wheel, bevel wheels, spur wheels, and screws, so that they can all be raised and lowered at one time. The two outside top rollers are also fitted with separate gear, so that they can be raised and lowered separately, as required to bring out the plate straight. Messrs. Smith Brothers & Co. also make similar machines to the foregoing, having eleven rollers, six above and five below, for rolling very thin plates. The machine exhibited has rollers 5 ft. 6 in. in length, 10 in. diameter. Another interesting exhibit of the last mentioned firm is a circular saw for cutting cold iron and steel. The saw exhibited has a diameter of 39 in., and is adapted for cutting cold iron or steel plates up to 6 in. of thickness and is very suitable for cutting built girders, beams, angles or pipes up to 12 in. diameter. Among the remaining exhibits of Messrs. Smith Brothers & Co., we noticed a lever punching and shearing machine for punching and shearing plates up to 1¼ in. thickness, a horizontal steam engine of 9 in. cylinder, fitted complete with governor and feed pump, a steam hammer, &c. After a close inspection of this Glasgow firm's exhibits, we feel assured that every care has been taken to render their machines efficient in every detail—and apparently their manufactures meet with due appreciation—as amongst the photographs at the back of the stand we saw one of a specially large plate planing machine that they recently supplied to the well-known firm of shipbuilders and engineers, Messrs. Harland and Wolff, of Belfast.

Messrs. Clarke, Chapman, Parsons & Co., of Gateshead-on-Tyne, have likewise a splendid assortment of their specialities. Their exhibits comprise their patent horizontal direct steam windlass, with spring riding brakes; a fine horizontal steam winch; a steam warping capstan; their patent steam steering gear; all more or less known to our readers. Altogether the stand of this firm

is very attractive, and in one corner a suitable back-ground is formed by a trophy of boiler plates, all flanged by hydraulic machinery. The patent "Clarke-Chapman" steam windlass is suitable for a steamer of about 4,500 tons, and the patent safety spring riding brakes, with which it is fitted, are of special advantage in obtaining better command of the cables in veering, and safety and ease in riding at anchor in heavy weather. The success which has attended the introduction of this patent windlass may be probably best estimated from the fact that during the last three years, over 500 have been fitted to steamers and sailing ships. The same firm's patent steam steering gear has been designed and successfully fitted for working with the full main boiler pressure of 160 lbs. per square in., without undue wear and tear of the engine. By thus avoiding the use of reducing valves, the element of uncertainty and unreliability consequent on their use is avoided. This steam steering gear appears to have amply large wearing surfaces, and well provided with the means for efficient lubrication. The steam warping capstan by Messrs. Clarke, Chapman, Parsons and Co. has been specially designed for use in yachts and small steamers and has a very snug appearance, the engine being exactly under the capstan. The steam winch exhibited presents no features of novelty, and requires no description, as this firm's manufactures in this department are well and favourably known. Allusion has already been made to the trophy of flanged plates, which, by the way, have been so arranged as to form an office. They have been all flanged by hydraulic machines, a process now generally adopted by Messrs. Clarke, Chapman, Parsons & Co., in preparing boiler plates requiring flanging, of which the economical advantages are well-known. One of the latest (if not the latest one exhibited) specialities of Messrs. Clarke, Chapman, Parsons & Co., is their patent turbo-electric generator, of which besides those exhibited at their stand, there are a large number at work in the Exhibition, for lighting the various courts, model lead and coal mines. A description of this patent turbo-electric generator may not be devoid of interest to our readers. The motor is composed of a compound steam turbine, working at a high rate of expansion, with great economy in the consumption of fuel. The motor is coupled direct to the armature of the dynamo, and both motor and dynamo run in bearings of special construction which are lubricated automatically and continuously by a special mode of circulating the oil, so that in spite of the high speed at which the machine runs, the wear and tear is reduced to a *minimum*. These machines are now being largely adopted both in mercantile and Government steam vessels, and as already indicated can be seen daily at work at the exhibition.

Messrs. M. Glover & Company, of the Potterdale Engineering Works, Leeds, exhibit working models of patent steam power firewood splitting and bundling machines, and also the Excelsior patent togglejoint firewood bundler, worked by the foot. Full sized machines, it is stated, will do the work of twelve to forty-eight men, and they are considered to be invaluable where, as in shipbuilding yards, there is waste wood to utilize. This firm also exhibits their special "saw-gulleting," and "topping" machine, well worthy of notice by those interested in this class of work.

Among the firms exhibiting at this exhibition, whose exhibits are of sufficient importance to warrant notice, although not specially interesting to marine engineers and shipbuilders, is that of Messrs. John Fowler & Co., Limited, engineers, of the Steam Plough Works, Leeds, Yorkshire; 6, Lombard Street, London, E.C.; Central Bahnhof, Madgeburg; Pflastergasse, Prag; Apartado, Habana; York Street, Wynyard Square, Sydney; Mangoe Lane, Calcutta; and Besakofskaja, Kiew. The exhibits of the last-mentioned firm are all of the most recently improved character, and are principally illustrative of their system of light railways, and rolling stock. No visitor should omit visiting Messrs. John Fowler & Company's building, which they have erected in the North Gardens, and in which are a variety of their specialities, while outside they have narrow gauge Greig's patent portable and semi-portable railway lines laid down, fully equipped in every respect. We would draw special attention to the magnificent improved 8 H.P. compound traction engine, which is to be seen among their exhibits inside their building, and which we are confident cannot be surpassed for carefulness of design and finish by any of the exhibits in the exhibition. We regret that pressure on our space precludes a detailed reference to the magnificent exhibits of Messrs. John Fowler & Co., Limited, as all of them will bear the closest inspection from any of our readers, and we would urge every one who visits the exhibition not to fail to pay a visit to this deservedly popular and enterprising company's stand.

(*To be continued.*)

WYNDHAM'S PATENT AIR & CIRCULATING PUMP VALVES.

THE accompanying illustrations represent a valve patented by Mr. J. S. Wyndham, of Cardiff, which has proved itself, after extensive trials on several vessels, to possess the essential qualifications of a good valve, viz., simplicity, rapidity, and certainty of action, and durability in a marked degree.

We need not dilate upon the disadvantages of a bad valve, or the loss of vacuum and other evils consequent thereon, nor need we show how such a valve would be dear at any price, but we will content ourselves by saying that, judging from the published testimonials that have been laid before us, Mr. Wyndham's valve leaves nothing to be desired as regards its efficiency and first cost. Turning now to the illustrations it will be seen that figs. 1 and 2 represent respectively a plan of a valve

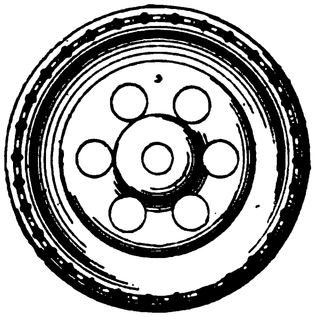


FIG. 1.

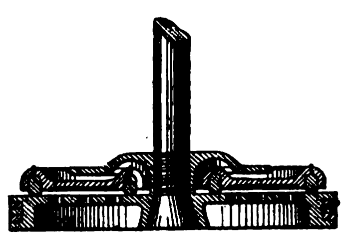


FIG. 2.

with guard fitted; and a sectional elevation of valve and guard fitted to the piston of an air-pump; while figs. 3 and 4 show a plan and sectional elevation of the valve as applied to a circulating pump. From these it will be

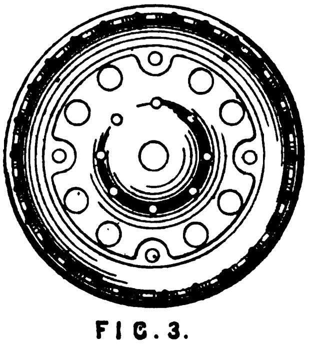


FIG. 3.

seen that the valve consists of a metallic disc, in the face of which are embedded two rings of hard packing (figs. 2 and 4) fitting into corresponding recesses turned in the face of the valve. This packing serves to keep the two

metallic faces apart, and also makes a perfect water or air-tight seal around both the outer periphery and the central orifice through which the pump rod passes. The annular groove lying between the concentric ridges on the back part of the valve serves to imprison a small quantity of water and so form a cushion, which, by assuring a resistance when the valve is being brought to rest, does away with all shocks and noise, and thereby

FIG. 4.

diminishes the wear and tear of the machinery. The small vertical pins of fig. 4 are fitted to keep the guard in position. These valves work equally well with slow or quick speed machinery, and will hold their vacuum for over 45 minutes. A set has been tested and found, after twelve months' wear, to be as good as when first put in. The inventor is to be congratulated for having placed a simple, reliable, and cheap valve upon the market.

COMPOSITE SCREW STEAMER.

On page 135 of our July issue there appeared a notice of a vessel, built by the Hong-Kong & Whampoa Dock Co., Limited, and launched at Kowloon Docks, on April 29th, while on page 107 of our June issue a notice of similar vessels built for the same owners by Messrs. George Fenwick & Co., of Praya East, was given. We now have pleasure in giving drawings of these vessels which, from their clearness, are self-explanatory, and need no lengthy description at our hands. We should, however, state that though the general arrangements and deck plans of all the steamers are alike, those built by the Hong Kong and Whampoa Dock Company are twin screws, while Messrs. Fenwick's vessels are single screw composite built boats, the frames and beams being of steel, as shown, while the planking, decks, and other erections are of teak. The vessels are of a handsome and pleasing design, and every arrangement appears to have been made to ensure the comfort and safety of all on board. The arrangement of cabins, decorations, &c., was fully gone into in our previous notices, so we need not recapitulate it here. On the official trial trip in the Canton river the *Con-Rong* attained a mean speed of 10·5 knots on the measured distance, a result considered highly satisfactory. The machinery worked without a hitch, and when running 170 revolutions no difficulty was found in maintaining a steady pressure of 100 lbs. per square inch. It is intended to fit an arc light in a projector on the awning-forward to enable the vessel to navigate the narrow rivers at night. Messrs. Marty and d'Abbadie have been awarded the gold medal at the Hanoi Exhibition for the design and model of the twin-screw steamers. A third boat on the same lines as the *Con-Rong* has been launched by the Hong Kong & Whampoa Dock Company.

The death is announced of Mr. John Kirkaldy, until lately senior partner in the firm of John Kirkaldy & Son, of West India Dock Road.

BERKEFIELD'S FOSSIL-MEAL COMPOSITION.

Now that triple-expansion engines and high pressures have become the order of the day, it is more than ever necessary that all steam-heated surfaces should be efficiently protected against radiation.

Not only is this necessary from an economical point of view, as it is calculated that the loss from steam-heated surfaces in a steamer amounts to as much as 8 per cent. of the fuel used, but it becomes imperative when the inconvenience that would otherwise be suffered by passengers and crew is considered.

As showing the loss due to radiation we may point out the results of a public test made with two 38 ft. 4 in. ranges of 5 in. pipes, the one covered with one inch of Berkefield's fossil-meal composition, and the other left bare. The temperature of the surrounding atmosphere was 88° F., analogous to the conditions that would obtain in a hot engine-room, while the trial lasted nearly five hours, perfectly dry steam of 53·45 lbs. per square inch being used. The uncovered range condensed 205·5 lbs. of water, while the covered ranged only converted 61 lbs. of steam into water, or a saving of 144·5 lbs. This worked out for twelve months' continuous running, and based on the assumption of 8 lbs. of water converted into steam of 53·45 lbs. pressure per lb. of coal, shows a saving of 15 tons of coal per annum. This, too, on a range of pipe presenting only 59 square feet of superficial area, and which could have been covered with fossil-meal composition for about twenty-one shillings.

Messrs. A. Haacke & Co., of Kieselguhr Wharf, Hackney Wick, London, E., the patentees and sole manufacturers, guarantee, if the composition is applied in the manner recommended by them, a saving of 95 per cent. of the heat that would otherwise be lost by radiation, and the importance of this, both as regards the coal bill and the comfort and health of the passengers and crew, need scarcely be pointed out. This great saving is due to the fact that more than 90 per cent. of the composition consists of the best Kieselguhrn, or infusorial earth, a material composed of myriads of minute organisms, and it is to the peculiar hollow form of these microscopically small atoms that the fossil-meal composition owes its high porosity and consequent high non-conducting power. Its porosity is testified by the fact of its specific gravity being as low as 0·3.

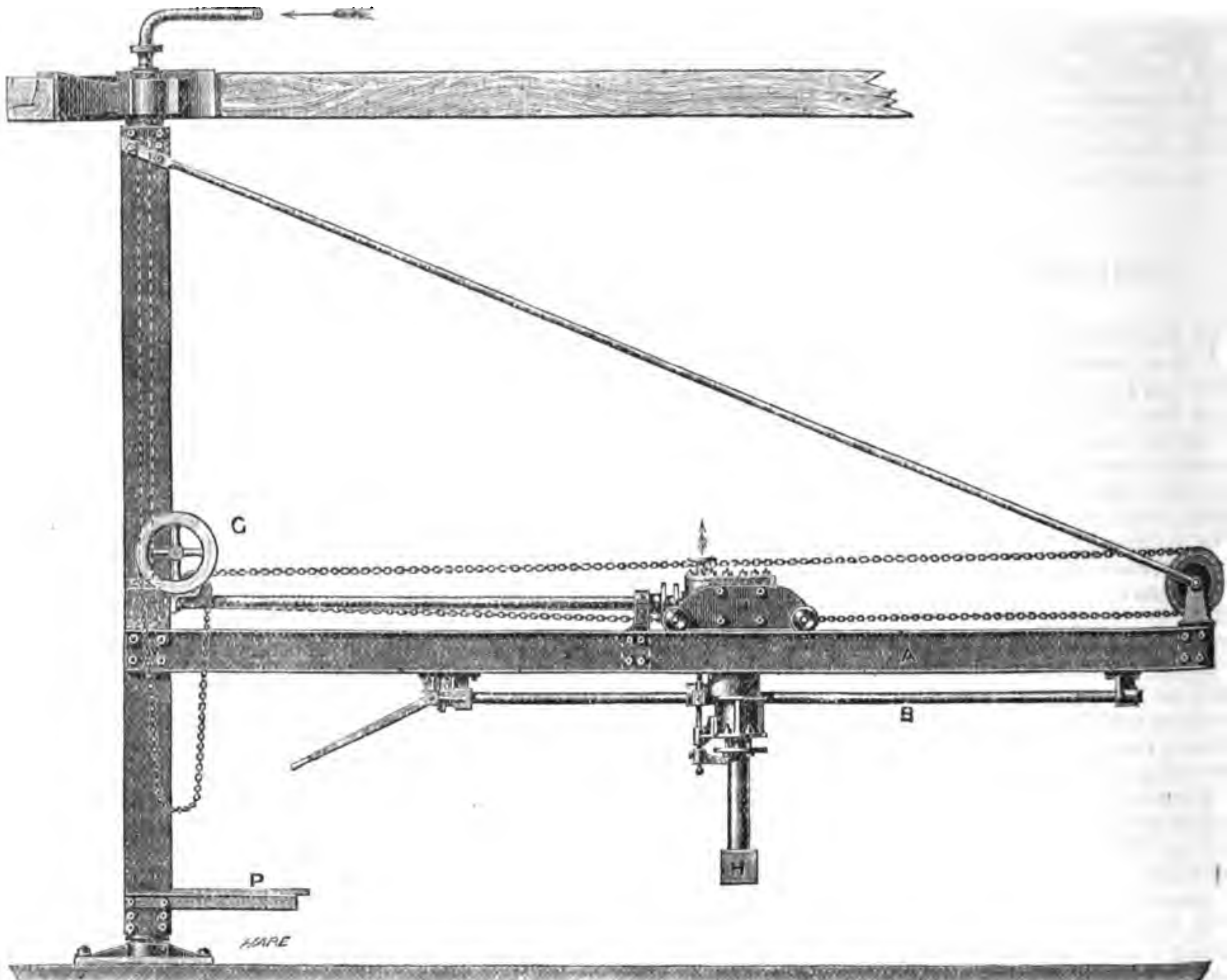
As stated in our last issue Messrs. Haacke covered the seven boilers, steam pipes, cylinders, &c., of the s.s. *Victoria*, built by Messrs. Caird & Co., for the P. & O. Company, and they are now engaged doing similar work on the s.s. *Britannia* for the same owners. In addition to many other eminent firms, The Central Marine Engineering Company, of West Hartlepool, are extensive users of the composition, they having covered the machinery in six vessels (aggregating 24,450 tons) with it, besides re-covering the boilers in a vessel of 3,100 tons. They are also covering four sets of engines now building by them, and also the machinery of the *Suez* on conversion from compound to quadruple expansion.

This firm are so satisfied with the results obtained by using the composition that they have determined, where possible, to apply it to all new machinery turned out by them.

We wish Messrs. Haacke every success with their admirable composition, and we are sure those of our readers who have enjoyed the luxury of working in a cool engine-room will join in our wish.

NEW RADIAL-ARM STEAM HAMMER FOR FORGING STERN-POSTS.

CONSIDERABLE difficulty has hitherto attended the forging of ship's stern frames in such a way as to weld the various parts of which they are composed into one substantial and rigid whole. This work has always been done by means of hand hammers made as heavy as men can wield. However heavy these hammers may be made, and however skilfully wielded, they are necessarily slow in action, and it has always proved difficult to obtain a thoroughly sound weld by their means alone. The impact of hand hammers is too light, and very frequently what appears a sound weld is merely a closing up of the surface of the mass operated upon. To overcome these defects and difficulties in the mode of uniting the component parts of ship's stern or rudder frames, Messrs. James Bennie & Co., of Clyde Engine Works, Polmadie, Glasgow, have invented a steam hammer that can be effectively employed in accomplishing this work with thoroughness and despatch. This hammer is carried on a long radial-arm, or horizontal jib, similar to that of a foundry crane, and can be worked at variable distances along the arm, which arm may be swung round a complete circle. The machine, as will be seen from our illustration, consists of a central column or pivot to which the radial-arm, preferably of wrought iron, is attached. On this arm the steam hammer H is mounted, and can be moved out or in on the arm by the racking gear G. The hammer is worked in the usual way by a man or boy who stands on the platform P, and controls the action by working the handle which is seen to the left of the hammer at the end of the horizontal bar B. This bar communicates with the valve gear on the cylinder, and the hammer H thus acts while in any position on the arm throughout the length of the rod. The horizontal steam pipe is telescopic, with stuffing-box, and the steam is usually led down through a stuffing-box in the upper pivot of centre standard or crane-post.



NEW RADIAL-ARM STEAM HAMMER FOR FORGING STERN-POSTS.

These hammers can be mounted on a travelling bogie on rails with steam boiler attached, and in this way the hammer can be brought into action along a smithy or forge of any length.

Messrs. Bennie & Co. have now made several of these hammers, the first having been supplied to Messrs. Alexander Stephen & Sons, Linthouse. It has been found a decided improvement over the old system of welding, and a great saving of labour wherever the machine has been adopted. The machine from which

our engraving is taken has recently been made for Messrs. William Beardmore & Co., Parkhead Forge, Glasgow.

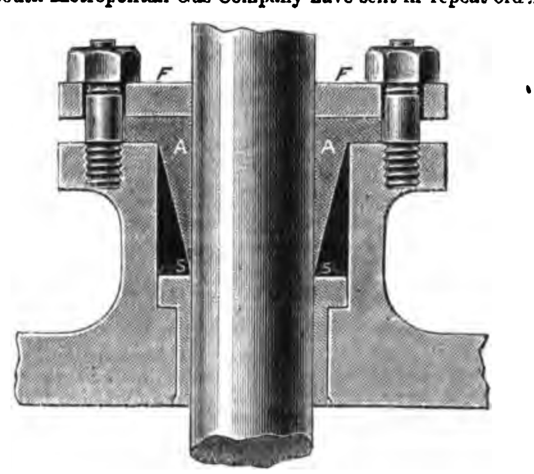
THE "GREAT EASTERN" ON THE CLYDE.

ALTERATIONS TO HER MACHINERY.

THAT which was recommended—if not predicted—regarding the employment of this great vessel by the late Mr. W. S. Lindsay, author of the standard historical work on "Merchant Shipping and Ancient Commerce," has literally come to pass. The gentleman named told Mr. Brunel, in the presence of the late Robert Stephenson, that if the vessel belonged to him he would "turn her into a show . . . something attractive for the masses," as she would never pay "as a ship." Whether or not, actual experience of the vessel's non-paying characteristics, prior to that time, justified this remark, it is certain that Brunel didn't relish the criticism; and it is equally probable, that, had he been living now, the fulfillment of Lindsay's semi-prediction to the very letter, would have added fuel to the fire of his resentment. In the early part of May of last year the *Great Eastern* was safely brought from Milford Haven, where she had been lying since 1875, and anchored in that part of the Mersey known as the Sloyne, almost within a stone's-throw of the celebrated ship-building and engineering works of Messrs. Laird Bros. Since that time the huge vessel has been taken to the Liffey, again removed to the Mersey for a time, and now finds herself the centre of attraction at the Tail of the Bank off Greenock. She left the Mersey on her latest move early on the morning of the 18th July, and, with the assistance of a powerful tug, she proceeded under her own steam at the rate of about eight knots, and dropped anchor at her present moorings about four o'clock on the morning of the 19th. Into the circumstances which led up to the vessel being employed as a "show-ship," or of her success in that capacity, it is not our intention to enter; but as the navigation of such a huge vessel from port to port and especially as the agents of propulsion have been her own engines, it will be of interest to state what has been done to fit the vessel for this work after years and years of inaction and consequent rust and decay. Her two recent passages, from Dublin to Liverpool, and from Liverpool to Greenock, have been quite uneventful—free from the hitches and break-downs which made her preceding voyages difficult and reponsible undertakings. That this has been so is in great measure due to the great improvements effected in the machinery department, which enables the ponderous engines, which naturally suffered at first from their long inaction, to be managed with ease and safety. This important work has been carried out by Mr. Peter Jackson, chief engineer of the great vessel since her removal from Milford, along with one or two engineer assistants. The work of overhauling both hull and engines, was instituted shortly after the vessel arrived in the Mersey from Milford, and the shortcomings made apparent by the first voyage after a period of 12 years motionlessness, were noted and seen to. The whole of the ship was pumped absolutely dry, and re-washed and coated with cement throughout the bilges and cellular compartments. The foolish rumour, for a time current about bricks and mortar being employed in the maintainence of watertightness of the hull, received its death-blow from the fact, that with the bottom quite dry, the ship was found as tight as when first launched. Until this overhaul, it had always proved difficult, if not impossible, to pump the bottom dry without the use of special Downton's or Pulsometer pumps. A discovery and an alteration made by Mr. Jackson, however, rectified this. Owing to the construction of hundreds of the sluice valves, which were of the hinged or clack design, the surfaces had never been properly accessible. On opening these for overhaul it was found that grit and corrosion to the depth of ¼ to ½ in. had accumulated between the valve surfaces, which fact sufficiently accounted for the constant difficulty of ridding the vessel of water. The valve hinges were, accordingly, so cut and adjusted that the valves can be examined, surfaces cleaned and coupled, or jointed up, in about ten minutes. Owing to the enormous crop of barnacles and seaweed which had accumulated on the bottom of the vessel and around the Kingston valves—in spite of the fact that a diver was employed for eleven days seeing after this and other features before leaving Milford—great difficulty was experienced on the voyage from a scarcity of injection water for the condensers. To remedy this Mr. Jackson fitted steam communication from the auxiliary boiler direct to each Kingston valve, so that with a pressure of 50 lb. or so the strum holes can be blown clear in an instant. The services of a diver or scarcity of water, no matter how foul the bottom may be, should in this way be experiences of the past. The main engines, auxiliary engines, and boilers have been thoroughly overhauled, including the fractured steam pipe which, it may be remembered, exploded, and caused the anchor to be dropped when leaving Milford. The diseased part of the main steam pipe in the neighbourhood was found to be only about $\frac{1}{16}$-in. thick in several parts, and the wonder seems to be that a terrible accident with fatal consequences did not take place. An improvement of great utility has also been made by the chief engineer in connection with the screw engines. Observing the slow and laborious operation of turning these engines by hand, through the medium of a crab winch and block and tackle, the system hitherto adopted on board. Mr. Jackson considered that the time and expense involved were such as to demand decided curtailment. To effect one complete revolution of the engines by this antiquated method, occupied eight men about three whole days. The improvement consists in applying steam power to do the work, by which the engines can now be turned in about twenty minutes. Utilising a small donkey engine which was fitted in the vessel when first launched, but which has not been used for a period of 14 years, owing to alterations in the machinery arrangements. Mr. Jackson has directly coupled to it a horizontal shaft about 20 ft. in length, at the extreme end of which is a wrought iron worm. This gears into a cast iron worm wheel 3 ft. in diameter, which transmits its motion by a second worm to the wheel on the main shaft which is 8 ft. diameter. The opening of a stop valve on the steam pipe to the donkey, sets the huge engines in motion. Considering the ease with which this obvious improvement has been carried out, and the economy resulting from it—the saving in men's wages alone, being estimated at from £80 to £100 per annum—it is somewhat strange that the matter should only now have been carried out. This and the various other improvements effected by Mr. Jackson, whose training was obtained in the largest Clyde workshops, reflects credit on his qualities as a practical and thoughtful engineer.

SKELTON'S PACKING RING.

THE patent inadhesive packing ring is the invention of Mr. Skelton, a marine engineer. It is manufactured for all valve uses and for locomotive regulators and injectors by Messrs. Grimshaw and Skelton, 50, Lower Kennington Lane, Lambeth, London. In addition to being the invention of a marine engineer, which by itself is a recommendation, the new packing ring is submitted to the public with the guarantee of efficient service, afloat and ashore, under as variable conditions as the most exacting could desire. The engineer of the *Sussex* writes, that "after prolonged steaming the valve of his steam pipe is movable by a finger touch." The South Metropolitan Gas Company have sent in repeat orders,



there being no chemical action upon the material of the packing ring under the severest tests, and no deterioration of structure under high temperatures. Similar testimony is borne by the Metropolitan Board of Works, the superintendent reporting that thirty-five spindles of sluice valves on boilers and main steam pipes, with spindles of steam tappet valves, packed on the 17th February, of the present year, continue on the 22nd June steam

tight and spindle free. Presently the Northfleet Cement Works will hand in their endorsement. Thus the new packing ring is equal to the varied requirements of stop valves, sluice valves, feed, scum, and blow off valves, and tappet valve spindles. The packing ring is a flanged cone, in constant readiness to be placed in position, and in as constant readiness to be removed from position without bother, thereby, in the latter case, getting rid of the possible spindle injury incident to the use and wont system of digging out the packing of a stuffing box with a file tang. With the new packing ring there is no cutting, and therefore no waste, nor is alteration necessary for the gland, which, if desired, may be placed upside down. The appearance of the packing ring when new is of ebonite; after wear the only apparent change is

in colour, the substance being unaltered, and the skin as smooth and faultless as when first put to use. There is not even a microscopic indication of adhesiveness. Necessarily, therefore, the packing ring will prove a boon alike to land and sea-going engineers, who have suffered in temper, if not in reputation, from valve spindles on special occasions setting fast when they should have worked free. Theoretically as well as practically the common practice of screwing down a gland for free spindle movement is absurd, and as soon as it becomes known that the practice is no longer needful will the patent inadhesive packing ring be more and more appreciated, until it becomes an inseparable item in all inventories of engineering stores. Mr. Skelton may well be complimented on his success in providing so adequately for a generally acknowledged want.

The United States Navy Department, having considered the contracts for the three new cruisers and two gunboats, has determined that one cruiser shall be built at San Francisco, and the other vessels on the Delaware River. The Department has ordered that the construction of the monitor *Miantonomas* shall be completed at New York. The prospect of a United States Navy is thus improving.

Manchester Ship Canal.—The Manchester Ship Canal Company have paid into the Bank of England the sum of £1,710,000 as purchase-money for the Bridgewater Canal and the Mersey and Irwell Navigation. The capital of the Bridgewater Company was £887,678, on which for some years a handsome dividend has been paid. The continuity of the business of general carriers will be maintained.

Torpedo Boats for the United States Navy.—The Secretary of the Navy, on July 23rd, signed an advertisement inviting proposals for the construction of one first-class torpedo boat, complete, exclusive of torpedoes and their appendages, the vessel to be of the best and most moderate design, to be constructed of steel of domestic manufacture, having a tensile strength of not less than 60,000 lb. per square inch, and an elongation in 8 in. of not less than 25 per cent., and to have the highest attainable speed. Proposals will be received until November 1st next. Premiums will be paid or penalties exacted according as the speed of the vessel shall be above or below 22 knots per hour. The cost of the vessel, exclusive of premiums, is limited to £18,000.

Progress in the United States Navy.—Captain Bunce, of the *Atlanta*, has officially reported the result of firing a couple of rounds from the guns of the new ship on July 15, at Gardiner's Island. He says:—"The result of this firing has been to completely disable both 8 in. breech-loading gun carriages, and to throw doubt upon the efficiency of the 6 in. breech-loading gun carriages and the three-pounder rapid-fire gun mounts. The arrangement of the battery has proved to be bad, as some of the guns have to be abandoned by their crews that the other guns may be fired at the target." The report enclosed shows in detail the extent of the damage, which consists mainly in breakage of electric light plant, driving in of panels, disarrangement of joiner work, breakage of cabin windows, and a slight splintering of the

INDUSTRIAL NOTES.

THE CLYDE AND EAST AND WEST OF SCOTLAND.

The output of new shipping on the Clyde during the month of August has been exceptionally large, as that for the previous month was unusally small owing to the holidays. As much as 15,180 tons were put into the river on one day alone, the 18th of August. Two were steamers of 10,600 tons aggregate, and two sailing vessels of 4,580 tons. Messrs. Russell & Co. of Port Glasgow, contributed both the sailing vessels, and Messrs. Caird and Co., and Stephen & Co., were the builders of the two steamers, the *Britannia* of 6,600 tons, for the P. & O. Company, and the *Warora* of 4,000 tons for the British India Company, respectively. On the 22nd, Messrs. Denny, of Dumbarton, launched a steamer of 5,200 tons which they have built on their own account. This and other work of less note raises the month's output to a very respectable figure. The launch of the large German Lloyd's steamers presently, on the stocks of the Fairfield yard, will take place early in September.

No fresh orders, however, of any consequence have been booked during the month, and matters in this respect are very little improved, although a more decidely hopeful tone prevails among shipbuilders and engineers. The principal orders, which have been placed since those noted in our last issue, are—two steamers each of about 2,500 tons, for Neppai Yusen Kaisha, of Japan, by the London and Glasgow Company; a screw steamer of 2,500 tons, 290 ft. in length, and of 2,000 H.P., for the Tasmania Steam Navigation Company, Hobart Town, Australia, by Messrs. A. & J. Inglis, of Ponithome; a steamer of 600 tons, to be engaged on the China coasting trade, by Messrs. Scott and Co., of Greenock; a tug steamer of the most powerful description, for the Clyde Shipping Company, by Messrs. Rankin & Blackmore, of Greenock; a stern-wheel steamer of 170 ft. length, for China, by Messrs. McArthur & Co., Paisley; a 600 ton double-ended paddle steamer for Indian river service, by Messrs. Scott & Co., Greenock; and a 1,000 ton paddle steamer for the London, Brighton, and South Coast Railway, received by the Fairfield Company, to fill the vacancy caused by the recent loss of the *Victoria*. It is currently reported that the Glen Line are about to entrust some fresh work to the London and Glasgow Company, from whom most of their vessels have been obtained; and that Messrs. Flemming & Fergusson, of Paisley, are likely to secure the contract for two large dredgers for Preston. The Royal Mail Company are inviting tenders from Clyde builders for a vessel of considerable size.

In addition to the North German Lloyd's vessel, and the two wood sheathed, steel protected cruisers of 2,950 tons each, already notified as being built for our Government by the Fairfield Company, they have on the stocks an 1,800 ton steamer for China service, to the order of Sir W. Pearce, the managing director of the Company. The five vessels in hand represent in all about 15,000 tons. The Company have also received orders from the Orient Company to re-engine the *Cuzco*, one of their steamers. The existing engines are compound, and the vessel is to be fitted with new engines of the triple-expansion type, 3,500 H.P.

The yard of Messrs. Napier & Sons has a very empty appearance, a steamer for Messrs. G. Thomson & Co., of Aberdeen and London, and similar to the *Australian* some time ago built by Messrs. Napier, being the principal item on hand. The *Galatea*, the second of the armed cruisers which this firm have recently built for the British Government, started on a preliminary builder's trial, on the 12th August; but just on reaching the measured mile, off Skelmorlie, an accident happened to one of the engines which had the effect of disabling it. The trial was not, therefore, carried out as intended, the vessel returning to the tail of the bank propelled by the other engine, and with the helm hard up. She was brought to Queen's Dock next day, where the necessary repairs are being carried out.

The s.s. *Electrico*, which has also recently been completed by Messrs. Napier, underwent a series of speed trials in the early part of the month. The average speed attained on the measured mile was 16·4 knots with forced combustion, and 15·9 with natural draught. Upon a deep sea trial of 200 knots the average speed was 15·4 knots with natural draught.

The London and Glasgow Shipbuilding Co. some time ago launched the solitary vessel they had on hand on their own account, but are now proceeding with the two Japanese steamers already alluded to, and as stated have views of new Glen Liners. At Messrs. Inglis, Pointhouse, matters are not very brisk, but they are better off by one vessel (already noticed), than they were

last month. They have on hand, besides the new order in question, a 5,000 ton steel "spec" steamer, and a 2,000 ton steamer for the British India Company. To the same company they recently handed over the paddle steamer *Ramapoora*, after very satisfactory speed trials. Messrs. Henderson, of Meadowside, are engaged with two Allan Liners for the Canadian cattle trade. At Linthouse, Messrs. Stephen have received no new work since last month, but they can afford to launch a few vessels before their yard will present the bare appearance of most of their neighbours' establishments.

Messrs. J. and G. Thomson, Clydebank, are pushing ahead with the two remarkable Inman Liners in which such a large amount of interest is centred. They have again been having trouble with the rivetters on account of the patent rivet-heating furnaces employed on the works, a dispute about which was noted in our May issue.

A singular explosion occurred on the 12th August on board the Spanish torpedo cruiser, *Reina Regante*, which Messrs. Thomson are completing at their dock. While a workman was examining the manhole of one of the cellular compartments with an open light an explosion occurred, injuring him and springing a plate, by which the water rushed in and filled the compartment. The cause is understood to have been an accumulation of foul gas in the compartment.

At Dumbarton matters are worse than they have been since the present depression set in. Messrs. Denny, at the beginning of the month, despatched a new steamer to New Zealand for the Union Company of that country, and they have lately finished extensive alterations on the *Dorunda*, of the British India Steam Navigation Company. On the 22nd they launched a large steel steamer of 5,200 tons, which they have built on "spec." She will have powerful engines on the quadruple expansion principle, and will be fitted with hydraulic deck machinery for working cargo, anchor, &c. This launch leaves Messrs. Denny with only one steamer of any size on the stocks. Their other work mainly consists of light draught steamers and barges for the Irrawaddy Flotilla Company. Messrs. A. McMillan & Son have nothing on hand, and their yard is practically closed, but rumour has it that a substantial order will ere long be booked. Messrs. Birrell and Stenhouse are in the same condition as McMillan & Son as regards dearth of work on hand, and Messrs. Murray Bros. have launched the only vessel they had on the stocks, the steam yacht *Thetis*, for Mr. Donaldson, of London, work on which is almost completed.

Matters at Port Glasgow assumed an active appearance during the month through the number of launches effected. Messrs. R. Duncan & Co., who have still one or two small jobs on hand, launched, on the 8th, a large screw steamer named *Baron Belhaven*. On the 9th Messrs. D. J. Dunlop & Co. launched a steel screw tug for the London & Tilbury Lighterage Company, and they have one other on hand.

Messrs. Russell & Co., of Greenock and Port Glasgow, as already shown, have launched quite a number of vessels during August, and they have still a goodly amount of work on the stocks of their two yards. The iron barque *Earlscourt*, which sustained much damage in being driven ashore last winter, was some time ago purchased from the underwriters by Messrs. Russell and Co., and they have repaired and refitted her, and disposed of her to Greenock owners, who will employ her in the Eastern trade.

The Greenock Foundry Company, in addition to the two sets of twin screw machinery of 2,000 H.P. each, for the *Daphne* and *Nymph*, being built in the Government dockyards, have other work on hand, and have contracted to supply triple-expansion engines for the double-ended paddle steamer contracted for by Messrs. Scott & Co.

At Dundee shipbuilding and engineering has for a long time been similarly circumstanced as on the Clyde. An important order, however, has just been received by Messrs. Pearce Bros. to build the first of several new mail steamers for the coasting trade of the Japanese Islands. The contract secured will afford employment to a large number of workmen, and will in all likelihood be followed by other orders.

A vessel will shortly be launched from the yard of Messrs. Pearce Bros. for Mr. William Croudace, shipowner, specially built on the most approved and substantial principals for the petroleum carrying trade. This trade is as yet little developed, and should this new enterprise in Dundee turn out a profitable one, it may soon form one of the staple industries of the town. The vessel, to be named the *Pollax*, has been built to class A1 at Lloyd's, and will have a speed, when loaded, of 9½ knots. Her length is 253 ft., breadth 36 ft., depth 19 ft. 8 in. She is fitted to carry 1,600 tons of oil, and 200 tons of bunker coal. An exhaust fan is fitted admidships for the purpose of drawing out all foul gases, and every precaution has been adopted for the protection of the cargo, and the lessening of the risk of fire. She will trade between Dundee and America on the Black Sea. The Caledon Shipbuilding Company, of Dundee, launched on the 22nd a square-rigged three-masted ship, named the *King Arthur*, for Messrs. Walker & Co., Glasgow.

The framework of the Glasgow Exhibition buildings is being rapidly erected. Some criticism is being passed upon the framework being composed wholly of wood. Attention is drawn to the fact that the localization of fires in exhibitions to the courts in which the outbreaks occur, is always due to the circumstance that the framework is of iron. The section for the fine arts, which is of brick, and is intended to be fireproof, is progressing rapidly. The contractors for the stand, pavilion, outer and inner palings, gates, and all other wood and iron work, are Messrs. T. Braby & Co.

An exhibition of industries and fine arts, organized by the Goran section of the Glasgow United Young Men's Christian Association, with the view of inaugurating their new premises in Morrison-street, Govan, and also of reducing a debt of £150, was opened for six days lately. To Govan, shipbuilding, engineering, and the cognate industries are of greatest importance, and therefore most atten'ion was bestowed on the section pertaining to these branches of trade. A full size model of the *Livadia*, built some years ago by the Fairfield Company—then John Elder & Co.—for the Czar of Russia, attracted much notice. Another fine model of the vessel most recently launched by the same Company, the *Empress*, was minutely examined in view of the sensational speed she has attained on her station between Dover and Calais. The Fairfield Company also exhibited engravings of engines and various engines built by them. A noteworthy item is a collection of photos in one frame representing the engines on hand at one time in the Fairfield fitting shops. The date was 1884, while yet the extraordinary briskness of 1882-3 prevailed. The engines represented were those for the *Umbria* and for her sister the *Etruria*, each of 14,500 I.H.P., those for the *Raumtaka* and her sister the *Karkoma*, each of 4,000 I.H.P.; and those for the twin-screw *Mackay Bennett*, of 2,200 H.P. In all an aggregate I.H.P. of 39,200, a truly marvellous amount of work. Messrs. Napier and Sons also displayed photos of some of their celebrated engines, and of their most recent warships *Australia* and *Galatea* as they were seen in the stocks. They also exhibited a model of the warships of the *Leander* class, three of which were built by them in 1881, and of the Italian s.s. *Sirio* of 4,000 tons. Models of two well known Clyde steamers are shown, the *Lultana*, and the Campbeltown steamer *Kinloch*, designed by Mr. Duncan Robertson, General Manager with the London and Glasgow Shipbuilding Company. A finely finished model represented a design by Mr. Alexander Denholm, Glasgow, of a paddle steamer, which, if built would, in some respects, eclipse the present Clyde steamers. The design was of a vessel with four decks besides the hold—awning bridge, main and lower decks. The latter two having state rooms and saloons. The members of the Association show models of yachts, and one exhibits a representation of a full rigged ship.

On the 19th inst. at the annual meeting of the subscribers to the Fund, which was organized in Glasgow, in July, 1883, for the relief of the widows and orphans of those who lost their lives by the capsizing of the steamer *Daphne* at launching, the Chairman of the Executive Committee—Mr. William McEwan—said that since the fund originated, the numbers receiving its benefits had been reduced from 270 to 116 at the present time. Since the meeting last year the number that had fallen to come off the list was nineteen. The recipients at present numbered fifty widows and sixty-five children. The capital was being reduced by £1,000 or £1,100 a year, but it still amounted to £21,386 11s. 2d., and by economical management, and by making safe investments, they had every reason to think that that would be sufficient.

The co-partnery of the Ailsa Shipbuilding Company, at Troon, has recently been augmented by an additional member, Mr. Carsewell, who has been until recently the principal in the department of Messrs. J. & G. Thomson's shipbuilding establishment, at Clydebank. The new member will, as at Clydebank, conduct the commercial affairs of the Ailsa Company. One iron steamer of 1,300 tons, some small craft, and one or two repair jobs to wooden vessels, represent the work on hand at present.

On the occasion of the approaching visit of the Channel Fleet to the Clyde, the Lord Provost and Magistrates of Glasgow propose inviting the officers to a grand ball in St. Andrew's Halls. The squadron, it is expected, will arrive off the tail of

the Bank on the 10th September. The *Great Eastern*, which is anchored off the Bank, will enhance the interest taken in this naval display.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The improvement referred to as having taken place in the Tyne shipbuilding trade last month, is further and more strongly indicated this month. Orders have been placed with several firms, and the area of employment for operatives, has unquestionably been greatly widened. Messrs. Palmer who last month had only two berths occupied, now have four vessels of the largest class on the stocks, and the preliminary work for laying down another has been commenced. These vessels have been ordered by firms at Liverpool and London, and all of them are to be fitted up in a superior style, and supplied with engines and boilers by the builders. Messrs. Hawthorn Leslie have secured, from a host of competitors, an order for two fast passenger steamers, each of which is to be 280 ft. long, and of proportionate dimensions in other respects. The firm had already half a dozen contracts for new work on their books, and they are therefore secure against slackness up to midsummer next year. Besides the new work the firm have four vessels to alter and re-engine. Messrs. Armstrong, Mitchell & Co. launched three large steamers during the month, one of whom being for French and two for German owners. The firm have still an abundance of new and old work in hand at their Low Walker Yard; but at the Elswick establishment only two berths are occupied, the vessels in hand being fast cruisers for foreign governments. Messrs. Wood & Skinner have now three vessels of good size on the stocks, and their yard is busier than it has been since the opening. Messrs. Dobson & Co. have obtained orders for a couple of large vessels, and the yard is likely to be fully employed during the remainder of the year. Messrs. Edward's yard, Howdon, has, after a long stoppage, been re-opened for work, an order for a large steel steamer having been secured. Messrs. Stephenson & Co. have a large vessel in frame on their stocks, and they are completing a set of powerful shear legs, to be erected on their new jetty. The engineering trade, like the shipbuilding, shows further improvement. Messrs. Hawthorn & Leslie have at least a dozen sets of triple-expansions to manufacture at their St. Peter's Works, and the pattern makers are now exceedingly busy. Messrs. Palmer have, as already indicated, secured a lot of work for their engineering department and both the Wallsend shipowners, and the North Eastern Works, at the same place are well provided with orders. Messrs. Baird & Barnsley, North Shields, having recently completed the re-engining of a cargo steamer, belonging to a leading Newcastle firm, are now engaged in repairing and overhauling the engines and boilers of a large tug boat. The firm have excellent facilities for carrying out either new or repair contracts, and will, no doubt, fully participate in the improved business now beginning to be manifested, Mr. Elringham, of the Stone Quay Boiler Works, South Shields, has for some time been busily engaged in furnishing a number of large vessels with new boilers. The works are provided with powerful shear legs, and are in every way well adapted for the special work mentioned. Mr. G. Tyzack sent away towards the close of the month, 100 patent anchors ordered by a Government department. This consignment completed an order for 300 given a few months ago. Messrs. Donkin & Nichol, of the St. Andrews Engine Works, Newcastle, have been doing a steady trade for some time past in the production of their patent steam and hand-steering gear, steam hoists, &c. Many of the former have been supplied to replace other gears that were found inefficient, and altogether the firm have manufactured over 260 of them. Messrs. Carrick & Wardale continue to have many inquiries for their specialities, and the works are kept steadily going. Messrs. Black & Hawthorn have just completed two powerful locomotive steam cranes for the Consett Iron and Steel Company, and they have several important contracts now in progress. Messrs. Abbot are manufacturing a large stationary engine for the Newcastle grain warehouse, and Messrs. Joicey & Co., Pottery Lane, are engaged in the construction of a hauling engine of great power, for a local firm of coal owners. Messrs. Hawks, Crawshay & Sons have resumed the construction of works for the production of steel according to the Siemens' process. These works were commenced about a year ago, but subsequently discontinued. There is no doubt, however, that the project will now be persevered in, and it is thought that the firm will be in a position to commence the manufacture at the beginning of next year.

The Wear.—The Wear Shipbuilding trade, instead of showing a tendency towards improvement, continues to decline. No orders for new vessels have been heard of lately, and very few repair contracts are being secured by local firms. Messrs. J. L. Thompson & Sons are preparing for launching a large vessel built to the order of Australian owners, and they have just completed the framing of a locally ordered vessel. This is the only work on the stocks, and there is but too much reason to fear that when the first mentioned vessel is launched there will be nothing to replace it. Messrs. Blumer having sold one of the two vessels that have been for more than a year on the stocks, have commenced frame-turning for a vessel to be built on the speculative principle. At the time of writing Messrs. Doxford are preparing to launch a torpedo boat upon the construction of which an extraordinary amount of care has been bestowed, and which, when tested, is expected to exhibit new features of special interest. Messrs. Short Brothers launched a vessel early in the month, which was named the *Roman Prince*, and is to form an addition to the Prince line of steamers. The firm have three other vessels in progress. Messrs. Osborne & Graham's yard, Hylton, has just been re-opened after a stoppage of nearly two years. The re-opening, however, is not caused by the acquisition of any new orders, but is to be attributed to the fact that a vessel that has stood in an uncompleted state on the stocks since the yard was last in operation, has been sold, and must consequently be completed forthwith, and subsequently prepared for launching. Messrs. R. Thompson and Sons are, in the absence of orders for new vessels, energetically devoting themselves to the repairing branch of the business, and on this line, they are achieving exceptional success, as they are never without three or four vessels on hand. Messrs. Bartram and Haswell has also been pretty well occupied during the month with an important repair contract. The Palmer's Hill Engineering Works, show some amount of improvement since last month. Several orders for crank shafts (Dickinson's patent), have been received, and an important addition has thus been made to the other work in progress. The firm have just completed the engineering of a fine vessel named the *Olive Branch*, built by Messrs. Bartram & Haswell for the Nautilus Steam Shipping Company. Messrs. Clark & Co., of the Southwick Engine Works, are engaged in engineering vessels, built by Messrs. Short Brothers and Mr. Laing. It is undertood that they have several sets of engines to proceed with. Messrs. Irving & Jopling, of the Pallion Boiler Works, have obtained from a local firm an order for a large stationary boiler, which is to supercede two good sized boilers now in use. Messrs. John Lynn & Co., continue to produce steam winches steering gears, &c., in considerable number, and Messrs. Wigham, of Hylton, are well provided with orders in a similar line. Messrs. Samuel Tyzack & Co., Iron Works, are kept steadily going, the demand for their specialities being on the increase.

The Tees.—Messrs. Raylton, Dixon & Co., landed on the 20th a splendid vessel named the *Gulf of Trinidad*, sister ship to the *Gulf of Aden*, landed by the same firm a few weeks ago, both being the order of the Greenock Steam Shipping Company. The firm have now but one small vessel with framing stage, all the remaining berths being empty. They are, however, extensively altering and repairing the s.s. *Explorer*, and are completing other fittings of a large vessel named the *Tartar* in Middlesbro' Dock. The firm, though now comparatively slack, have turned out some remarkably fine ships during the past twelve months, and it is generally felt in the locality that their deservedly high reputation as shipbuilders will, even in these dull times, be the means of soon bringing further orders to their yard. At Stockton, Messrs. Richardson & Duck and Messrs. Taylor & Craig have been tolerably successful in securing orders lately. The former firm have just commenced the construction of six barges, and they have also laid keel for a large vessel lately. The other firm referred to are busy framing a vessel, and it is stated that they have others to lay down. Messrs. Pearse & Co. are plating a vessel of the largest class, and in this case also the belief exists that there are other orders to follow. Messrs. Blair & Co., marine engineers, have engined an exceptionally large number of high class vessels during the present year, and have still several important orders in progress or reserve. The whole of their large establishment is kept going night and day, and it is stated that more hands are employed than at any time within the past four years. Messrs. Head, Wrightson & Co. are doing but a limited business just now in their bridge building shops; but

some heavy contracts for metal pipes, &c., are in progress in their iron foundry department, which at present is as heavy as could be wished. There is a lack of orders at the Stockton forge, but Messrs. Ashmore, Benson, Pearce & Co., manufacturers of gas making plant and other specialities, are having some good contracts in course of execution. There is little else but dulness to note in connection with the Teesside iron trade, but steel works are in full activity, and the future outlook is good.

The Hartlepools.—The shipbuilding establishments continue doing a comparatively active business, and prospects for the winter are nothing like so doubtful as at other centres of the industry. The marine engineering establishments are also exceptionally well employed, and this being the active season so far as the importation of timber is concerned, business at the docks is more than ordinarily brisk.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Rubens.—On July 21st there was launched from the shipbuilding yard of Messrs. J. L. Thompson & Sons, North Sands, Sunderland, a steel steamer of the following dimensions, viz.:—Length, 275 ft.; breadth, 38 ft.; depth of hold, 20 ft. 6 in.; built to the order of Messrs. Bolton & Kenneth, of London, under special survey of the highest classification. The decks are entirely of steel, the cargo holds being sub-divided by six steel bulkheads, to which each longitudinal intercostal is efficiently connected. The deck machinery consists of direct steam windlass, four large horizontal steam winches, by Lynn, of Pallion; also patent steam steering gear, by Holliday, of Sunderland; and patent stockless anchors, by Wastney Smith, arranged to stow up hawse pipes. The engines are of the triple-expansion type, and are being built by Messrs. T. Richardson & Sons, and are of 1,000 I.H.P., having two steel boilers, working at a pressure of 160 lbs. per square inch. The construction of ship and engines has been under the supervision of Mr. Terrot Glover, of Sunderland. The ceremony of naming the vessel *Rubens* was performed by Miss Pearse, of Plymouth.

Ibis.—On July 23rd Mr. W. Walker launched from his yard at the Upper Globe Dock, Rotherhithe, a sailing vessel of about 100 tons, constructed for the committee of Pilotage of Demerara, under the orders of Messrs. Sprotson & Son, of London. She is 102 ft. long, 21 ft. broad, and 10 ft. deep. She will be schooner-rigged and fitted with all the latest improvements. The vessel appears to be well adapted for the purposes for which she is required, and is also designed to be used as a lightship if necessary. As the vessel left the ways she was christened the *Ibis*, the ceremony being performed by Miss Thirkell.

Port Denison.—On July 23rd there was launched from the yard of Messrs. R. & W. Hawthorn, Leslie & Co., Limited, at Newcastle, a steel steamer, built on the spar-deck type, for Messrs. Wm. Milburn & Co.'s Australian line. Her dimensions are:—Length over all, 387 ft.; beam, 42 ft.; depth of hold, 28 ft. 6 in. The vessel has been named the *Port Denison*, and is intended to make the run to Australia in about 38 days. She is to be barque-rigged, with a large spread of canvas and a handsome clipper stem. She is considerably above Lloyd's requirements, having extra web frames amidships and sheer strake doubled, and has been built under Admiralty survey for the transport service, for which she is throughout particularly adapted. Accommodation for about fifty first-class passengers is provided. Particular attention will be given to bath-room accommodation, and especially to ventilation and sanitary matters. In the 'tween decks berths will be provided for 400 to 500 third-class passengers, and cooking arrangements for 1,000 troops or emigrants. Beneath the bridge is placed a smoking saloon, the necessary dispensaries, bakeries, bath rooms, and doctors' officers', and engineers' berths; whilst in the forecastle on the upper deck are berthed the sailors and firemen. The *Port Denison* is being fitted by Messrs. Wigham, Richardson & Co. with triple-expansion engines, the diameter of the cylinders being 31 in., 46 in., and 78 in., with a stroke of 54 in. The boilers are three in number, possessing a very large heating surface. An unusually large supply of spare gear is carried, and the cylinders are so arranged that in case of accident to any one of them the remaining two can in a few minutes be converted into a compound engine.

Colorado.—On July 25th Messrs. Earle's Shipbuilding and Engineering Co., Limited, launched from their yard at Hull, the s.s. *Colorado*, which they have built to the order of Messrs. Thos. Wilson, Sons & Co., for their Atlantic trade, her dimensions being 370 ft. by 44 ft. 6 in. by 28 ft. 6 in. She has a long full poop, and a long topgallant forecastle extending abaft the foremast, the bulwarks between them being carried up to the same height, and is built to Lloyd's highest class in steel with a double bottom all fore and aft, on the cellular systems, divided into five watertight compartments for water ballast. She has a compound steel and iron stern frame, and a steel rudder made by Wm. Jessop & Sons, Sheffield. Accommodation for 26 first-class passengers is provided under the poop deck, at the fore end of it, in large staterooms, where will be built a spacious saloon in hardwoods, polished and handsomely finished. The captain and officers' quarters with cabin entrance are in a deckhouse over the cabins, and the engineers and firemen are berthed at the sides of the engine room. It is intended to rig her as a barque with 3 masts, and for steering one of Amos & Smith's steam steering engines and gear have been fitted. The machinery, also made by the builders, is of 400 N.H.P., and have cylinders 31 in., 50 in., and 82 in. diameter by 57 in. stroke, these being arranged on the triple-expansion three crank system, and steam is supplied from three steel boilers—two double ended and one single ended—made for a working pressure of 160 lbs. per square inch.

Fifeshire.—There was launched on July 28th, from the shipbuilding-yard of Messrs. C. S. Swan & Hunter, Wallsend, a steel steamer, built to the order of Messrs. Turnbull, Martin and Co., of Glasgow, specially for trading and carrying dead meat between Australia, New Zealand and London. The dimensions of the vessel are as follows:—Length, 355 ft.; breadth (extreme), 48 ft.; depth (moulded), 27 ft.; deadweight cargo, about 5,000 tons, all told. She is classed 100 A1, three deck grade, at Lloyd's, and built of Siemens-Martin steel, on the cellular double-bottom principle, having water ballast all fore and aft. This vessel has been built exceptionally strong, having deep web frames on every fourth frame throughout the holds. She has a long poop extending to fore side of engine and boiler space, and a long topgallant forecastle. The holds are fitted up as refrigerating chambers. The refrigerating machinery (Lightfoot's patent) is of the latest and most approved type. The poop will be fitted with a large saloon and state-rooms for about 50 saloon passengers, for whom fresh meat will be carried in a refrigerating chamber. The accommodation for officers and engineers is also under the poop, at its fore end. The crew and firemen are berthed under the topgallant forecastle. The vessel is fitted with a powerful M'Onie's steam windlass and sentinel steam steering gear, and large steam winches for each hatch. She will be brigg-rigged, with steel masts. The triple expansion engines, which are of about 3,000 I.H.P., and driven by three double ended multitubular steel boilers, working at 160 lbs. pressure, are being supplied by Messrs. Blair and Co., Limited, of Stockton. The steamer is fitted throughout with the electric light, including cargo lanterns, masthead and side lights, by the Maxim Weston Electric Light Company, Limited. She will have a Board of Trade passenger certificate, and will be placed on the Admiralty list for transport service, her beam making her an advantageous transport in time of war. The vessel was christened the *Fifeshire* by Mrs. James Huddart, of Melbourne. The building of the steamer has been superintended by Mr. Wotherspoon, of Glasgow.

Olga.—On August 2nd Messrs. Laird Brothers launched from their Birkenhead Iron Works a twin screw steamer for the London and North Western Railway Company, to be employed between Holyhead and Dublin. She is built of steel manufactured at the company's works at Crewe, the sternpost and rudder of cast steel by Jessop & Sons, Sheffield. Her dimensions are:—Length, 300 ft.; breadth, 33 ft.; depth to maindeck, 13 ft. 6 in.; tonnage, b.m., 1,623 tons. She is fitted with poop bridge deck and topgallant forecastle, and has been designed for carrying cattle, the special fittings necessary being carefully arranged. The accommodation is limited to that required for cattle, drovers, and crew. The engines, which are completely erected in the shop, are two pairs of direct-acting triple expansion engines, to indicate 1,800 I.H.P., and are supplied with steam from two double-ended boilers, working at 150 lbs. pressure. She is fitted with patent direct acting windlass by Emerson, Walker & Thompson Brothers, Limited. The ship was named *Olga*, the christening being performed by Miss Olga Dent, daughter of Admiral Dent, R.N., marine superintendent of the company's fleet at Holyhead.

Ethelburga.—On August 3rd there was launched from the shipbuilding yard of Messrs. John Readhead & Company, West Docks, South Shields, a steel screw steamer, of the following dimensions:—290 ft. by 38 ft. 6 in. by 19 ft. 11 in. The vessel

has a full poop and quarter deck, bridge amidship, extending to foremast and top gallant forecastle; is built on the cellular bottom principle for water ballast, and will be classed 100 A1 special survey at Lloyd's. The vessel will be fitted with triple-expansion engines, cylinders having diameters 23 in., 37½ in., and 61 in., 39 in. stroke, and will work at a pressure of 160 lbs. The engines are supplied with steam from two large steel boilers. Engines and boilers also being built by Messrs. Readhead & Co. The vessel has been bui t to the order Messrs. Dillon, Harrowing & Co., London, and was named the *Ethelburga*, by Mrs. Dillon. The vessel has been built under the superintendence of Mr. Samuel Walton, owner's inspector.

Roman Prince.—On August 4th, Messrs. Short Bros. launched from their yard at Pallion, Sunderland, a screw steamer, built to the order of Mr. James Knott & Partners, Newcastle-on-Tyne. The vessel, which is of the raised quarterdeck type, with cellular double bottom, is constructed of Siemens-Martin steel throughout, to the highest class in Lloyd's Registry, under special survey, and is of the following dimensions:—Length, 290 ft.; breadth, 38 ft. 9 in.; and depth, moulded, 20 ft., with a dead weight carrying capacity of about 2,900 tons. She is to be fitted with triple-expansion engines, of 180 N.H.P., by Mr. George Clarke, of Southwick, the boiler being of steel, and having a working pressure of 150 lbs. per square inch, and patent steam windlass, Emerson, Walker, & Co.'s patent. On leaving the ways the vessel was christened *Roman Prince* by Miss Shawcross, of Scarborough.

Springfield.—On August 4th Messrs. W. Gray & Co., launched from their yard a steel screw steamer of the following dimensions: 298 ft. length overall, 37 ft. 6 in. beam, 22 ft. 2 in. depth, moulded, built to the order of Messrs. Pyman Bros., London. The vessel takes Lloyd's highest class, and has large carrying capacity. She is of the improved well-decked type, having the bridge extended forward of the foremast. The poop aft contains handsome saloon and accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore part of the bridge. Emerson Walker & Co.'s patent windlass is fitted forward. The hull is built with web frames, giving strong sides and dispensing with hold beams, thus avoiding any obstruction in the working of cargo. A cellular double-bottom is fitted for water ballast throughout. Five hatchets, two donkey boilers, four steam winches, and steam stearing gear are fitted, and the ship is thoroughly equipped as a general trader. The engines are of the triple-expansion type, of 1,100 H.P., working on three cranks. They are supplied by the Central Marine Engineering Co., West Hartlepool. The cylinders are 23 in., 36½, in. and 62 in. diameter, and the piston stroke 39 in. The boilers, built of steel, are of large size, and will give an ample supply of steam at a working pressure of 155 lbs. The vessel has been superintended during construction, on behalf of the owners, by Captain T. Pyman. The christening ceremony was gracefully performed by Miss May Pyman, West House, West Hartlepool, the vessel being named *Springfield*.

Roddam.—On August 5th Messrs. Edward Withy & Co. launched from Middleton shipyard, West Hartlepool, a steel screw steamer built to the order of Messrs. Steel, Young & Co., of London and West Hartlepool. This is the 147th vessel on the builder's books, and the 25th they have built for the same owners. She is a handsome type of cargo vessel, 300 ft. long, and of a large deadweight carrying capacity, built on the cellular bottom and web frame system, dispensing with beams in the lower hold, and with large hatchways so arranged that she can carry torpedo boats, guns, machinery, boilers and bulky cargo of the largest description. The vessel has a topgallant forecastle and long bridge house extending to the fore side of the foremast, long raised quarter-deck, and short poop aft. The bulwarks, rails, decks, etc., are of iron. She will be fitted with four steam winches, one direct steam windlass, two donkey boilers, and steam steering gear, and will be rigged as a two-masted topsail schooner. The steamer has been built to Lloyd's 100 A1 c'ass, and under the personal superintendence of Mr. Steel. She will have triple-expansion engines with two single ended boilers by the well-known firm of Messrs. T. Richardson & Sons, Hartlepool. It is interesting to note that the owners of this vessel were the first to adopt triple-expansion engines on the north-east coast, and so far back as 1880 they had the steel steamer *Cyanus* built by Edward Withy and Co. On leaving the ways the vessel was christened *Roddam* by Mrs. W. Young, of London.

Cordoba.—On August 6th Messrs. M. Pearse & Co. launched from their shipbuilding yard at Stockton-on-Tees, a steel screw steamer of the following dimensions:—Length between perpendiculars, 320 ft., breadth extreme, 40 ft., depth of hold, 27 ft. 4 in. She will be classed ✠ 1 3-3 in the Bureau Veritas Registry. She has been built to the order of the Compagnie Chargeurs Réunis of Paris, and is intended to be placed on their line between Havre and South America. Her engines are by Messrs. Blair & Co., Limited, on the triple-expansion principle, with all the latest improvements, and are of sufficient power to give a speed of 12 to 13 knots per hour. As she left the ways she was christened *Cordoba* by Mrs. Héron, of Havre.

Elingamite.—On August 6th, there was launched from the shipbuilding yard of Messrs. C. S. Swann & Hunter, Wallsend-on-Tyne, the *Elingamite*, the third steel screw steamer built for Messrs. Huddart, Parker & Co., of Melbourne and Sydney, &c. The following are the dimensions and particulars, viz.:—Length, 320 ft.; breadth, 40 ft. 9 in.; depth, 22 ft. 3 in., giving a cubic capacity of 4 000 tons. The vessel has a long full poop, under which there will be a saloon the full width of the ship, and staterooms to accommodate 110 first-class passengers. In addition to the usual means for ventilation a large tube runs fore and aft the full length, fitted with sliding ventilators, and so arranged that all hot and foul air can at once be carried away. The topgallant forecastle is arranged for the accommodation of over 100 second-class passengers. There is a deck house at the fore end of poop to accommodate captain, with chart-room and smoking-room. In addition to the usual oil lamps, the steamer will have a complete electric light installation. The electric light will be in every state room, forward and aft, on the side and on deck, for discharging cargo, &c., and will be adapted in every way with the latest inventions in this branch. To facilitate the rapid loading and discharging of the cargo there are five steam winches and four steam cargo whips for discharging from two hatches at the same time, steam being supplied from a donkey boiler of unusually large size. Steam steering gear amidships and direct-acting steam windlass, fitted with large warping drums. The vessel has a capacity of over 800 tons for water ballast in a cellular double bottom, the engines are on the triple-expansion principle, are built by the Wallsend Slipway and Engineering Company, Limited, Wallsend, and are capable of indicating about 1,800 H.P., and it is intended to propel the vessel 14 knots an hour. On leaving the ways she was named the *Elingamite* by Miss Traill, the daughter of Mr. Traill, one of the owners. The *Elingamite* will be classed 100 A1 at Lloyd's, and have a Board of Trade certificate for foreign-going passengers, and is placed on the Admiralty List of Transports. This vessel has also been selected by the Victorian Government to be fitted as an armed cruiser in time of war. The gun foundations are now being fitted. She will carry two 36 pounder Armstrong guns on the forecastle and two on poop, together with several rapid firing guns amidships. Two large steel lifeboats are fitted, and several boats have the most approved life-saving apparatus applied.

Olinda.—On August 17th there was launched from the Low Walker shipbuilding yard of Sir W. G. Armstrong, Mitchell & Co., a steel screw steamer named the *Olinda*. The vessel is intended for the passenger trade between Hamburg and the Brazils. She is 320 ft. long, 40 ft. beam, 25 ft. depth of hold. She is built with cellular bottom right fore and aft, in accordance with Veritas rules for the highest class. Immediately on being launched she proceeded to the Wallsend Slipway and Engineering Co.'s works, where she will be fitted with triple-expansion engines, capable of propelling her at a speed of 12 knots.

Ariosto.—On August 18th Messrs. Russell & Co., shipbuilders, Greenock, launched from their yard a steel screw steamer of 2,989 tons gross, with a carrying capacity of 4,000 tons, and of the following dimensions:—Length, 320 ft.; breadth, 40 ft.; and depth, 22 ft. On leaving the ways the vessel was named *Ariosto* (after the great Italian poet) by Mrs. Lithgow, wife of one of the partners of Messrs. Russell & Co. The *Ariosto*, which is intended for the South American trade, has been built to the order of Messrs. Robert M'Andrew & Co., shipowners, London, and is sister steamer to the *Tasso*, launched for them a short time ago by the Messrs. Russell. Her engines, which are of 250 N.H.P., are on the triple-expansion principle, with forced blast, and have been made by Messrs. James Howden & Co., engineers, Glasgow. The *Ariosto* has been built in excess of Lloyd's highest requirements for the 100 A1 class, her construction having been superintended by Mr. Kennedy (the superintendent of Messrs. M'Andrew's line of steamers), assisted by Mr. Bartlett, one of the company's engineers. She has a saloon amidships, and accommodation for for 12 first class passengers. She has two steel decks, and an orlop deck of wood, and being specially designed as

a cargo carrying steamer, the *Ariosto* has been furnished with all modern appliances for facilitating the loading and discharging of cargo, including five steam winches by Messrs. Clarke, Chapman, and Parson, of Newcastle; and steam windlass by Messrs. Harfield & Co., London; and she is fitted with Wastney Smith's patent stickless anchor, stowing up hawse pipes. The steam steering gear is by Messrs. Davis & Co., London. We may further add that her bunkers are capable of holding 780 tons of coal, and that she carries 360 tons of water ballast in her double bottom. The *Ariosto* will be command by Captain Mollard, late of the *Dante* (s), belonging to Messrs. M'Andrew & Co.

Alice Depreaux.—On August 20th there was launched from the yard of Palmer's Shipbuilding and Iron Company, Limited, a new and handsome steamship, which has been built to the order of Messrs. Felis Depreaux & Son, of Rouen, and named the *Alice Depreaux*. The vessel, which is of steel, includes all the latest improvements, and will take the highest class at Lloyd's. She is 220 ft. in length, her beam being 32 ft., and depth 17 ft.; and her deadweight capacity is over 1,300 tons. The *Alice Depreaux* is of the well-decked type, with long bridge, beneath which are cabins for officers, topgallant forecastle providing accommodation for the crew, and long raised quarter deck with hood over the stern. Mr. Price's patent self-trimming hatches have been adopted in her construction, and the vessel is fitted for water ballast on the cellular bottom principle. Harfield's direct steam windlass and capstan, two powerful steam winches, and other modern fittings will be supplied, and the engines, also built by the Palmer Company, will be 120 N.H.P. The vessel was constructed under the superintendence of Captan Thomas, representing the owners.

Gulf of Trinidad.—On August 20th there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., Middlesborough, a vessel named the *Gulf of Trinidad*, sister ship to the *Gulf of Aden*, recently built for the Greenock Steamship Co., Limited, for their Australian Line. She is built on three deck rule to the highest class at Lloyd's, of the following dimensions:—Length, 312 ft. 6 in. by 40 ft. by 25 ft. 2½ in., and will carry 3,500 tons dead-weight. Has water ballast in chambers, long poop bridge and forecastle extending almost the whole length, and every convenience up to the most modern style for a first class merchant steamer. In addition she is fitted with handsome saloon and cabins for 30 first class passengers. She will have engines of 300 H.P. by Messrs. Blair and Co., Limited, of Stockton. On leaving the ways she was christened the *Gulf of Trinidad* by Miss Stewart, of Greenock.

Galatea.—On August 22nd there was launched from the yard of the Sunderland Shipbuilding Company, Limited, an Iron Screw Steamer, built to the order of Messrs. Leach & Co., of London. The leading dimensions of the vessel are:—Length, 180 ft.; breadth, 27 ft.; depth of hold, 13 ft. Classed A1 Lloyd's under special survey, having raised quarter deck, bridge, and top-gallant forecastle. The steamer is specially designed for the general cargo trade between London and Ghent, and is fitted with steam steering gear by Messrs. Donkin and Nichol, and three powerful steam winders by Messrs. Clarke, Chapman & Co., of Gateshead. The saloon, together with the captain and officers' accommodation, is placed amidships; the crew are berthed in top-gallant forecastle. The main engines are on the three crank triple compound principle, by the North Eastern Marine Engine Company, Limited, having cylinders 16 in. by 26 in. and 43 in. diameter, by 30 in. stroke; working pressure 150 lbs. per square inch. Upon leaving the ways she was gracefully named *Galatea* by Miss Horsley, of Bradford.

Bencroy.—On August 22nd Messrs. John Jones & Sons launched from their shipbuilding yard, Brunswick Dock, Liverpool, a steel screw steamer 300 ft. by 28 ft. by 30 ft., built to the highest class at Lloyds, under special survey. She will carry 3,600 tons dead weight, and a very large measurement cargo. She will be fitted by the builders with triple-expansion engines working at 160 lb. pressure, which have been designed to economise fuel to the fullest extent. Compared with iron steamers and ordinary compound engines there can be no doubt of the superiority of vessels of this class. The steamer was built for Mr. Joseph Hoult, of Liverpool, and was gracefully christened as she left the ways by Miss Hoult.

Esperanca.—On August 23rd Messrs. Laird Brothers launched from their Birkenhead ironworks the twin-screw steamer *Esperança*, the first of two which they are constructing to the order of the Amazon Steam Navigation Company (Limited), and which are to be employed on the River Amazon, in connection with an extended service which the company has undertaken under contract with the Brazilian Government and the provincial Governments bordering on the river. The ceremony of christening was performed by Mrs. Hollocombe, wife of Mr. John Hollocombe, the chairman of the company. The twin-screw system has been adopted, as possessing advantages for the navigation of the river, in connection with which moderate draught of water and extreme handiness are of great importance, the hull being steel, to Lloyd's highest grade of classificatinn for river service, and divided by longitudinal and athwartship bulkheads into 11 watertight compartments by which security against accident is ensured. There is an awning deck supported on stanchions and open at sides above the main rail, and a feature in the construction of the vessel is that the area of the main and awning decks is much increased by sponsoning out beyond the sides, the sponsons being specially protected against snags by permanent iron guards attached to the supporting stays. The dimensions of the *Esperança* are:—Length, 181 ft.; beam, 28 ft.; over sponsons, 36 ft.; depth in hold, 9 ft. 6 in.; tonnage, O.M., 680 tons. She is intended to carry about 200 tons deadweight on 6 ft. 6 in. draught of water, and to have a speed of 12 knots. The machinery consists of two sets of compound triple-expansion engines, each with its surface condensor air and circulating pump, and capable of exerting about 750 I.H.P. collectively, steam at 150 lbs. pressure being supplied by a cylindrical steel boiler with four corrugated furnaces, the machinery combining all the latest improvements, with a view to economy in fuel and stores, which is of vital importance in such service as that for which these vessels are designed. The *Esperança* has accommodation for 60 first-class passengers in state rooms on the forward part of awning deck. The officers' quarters are on the main deck aft, and the crew are berthed in a topgallant foresection. Provision is also made on the main deck for carrying a number of cattle. The whole of the wood work of decks, deck houses, and cabin fittings is of teak. The cargo will be worked through four side hatches by powerful steam winches, and the general autfit of the steamer will be very complete, including steam windlass, steel boats, &c. The *Esperança* is the fifteenth steamer built for the Amazon Steam Navigation Company by the Messrs. Laird.

LAUNCHES.—Scotch.

Araucana.—On July 22nd there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, a steel screw tug, 40 ft. by 8 ft. by 4 ft. 6 in. moulded. This vessel is built entirely of steel, including decks, skylights, &c., and is intended for carrying passengers and towing purposes on the Chilian Coast of South America, being fitted up complete in every respect as a sea-going boat for this purpose. The engines, which are being supplied by Messrs. Lees, Anderson & Co., Glasgow, to whose order the vessel has been built, consist of a pair of high-pressure cylinders 6½ in. diameter, with steel return tube boiler 6 ft. long by 5 ft. diameter, and are intended to drive the vessel at a high rate of speed. As the vessel left the ways she was gracefully named the *Araucana* by Miss Jessie Martin, Pollockshields, Glasgow, in the customary manner.

Gargo.—On July 22nd Messrs. D. McGill & Co. launched from their shipbuilding yard at Irvine a screw steamer to the order of Messrs. Ross & Duncan, Glasgow, who will supply the engines. She is built of mild steel to the highest class at Lloyd's, her dimensions being: Length, 88 ft.; breadth, 17 ft.; depth, 9 ft. On being completed she will proceed to Portugal, where she will be engaged in the salvage and towing trade. For that purpose she has been fitted with powerful pumps, and her engines will be of 230 H.P. The steamer was built under the supervision of Captain Beaton. On leaving the ways she was named the *Gargo* by Miss Peacock.

Thetis.—On July 23rd Messrs. Murray Bros. launched from their yard at Dennystown, Dumbarton, a finely-modelled steel-screw yacht, named the *Thetis*, built to the order of Mr. John Donaldson, Chiswick, London. The vessel is of the following dimensions, viz.:—Length between perpendiculars, 170 ft.; breadth, moulded, 25 ft.; depth, 15 ft. 6 in. Her tonnage is 480 tons yard measurement. The *Thetis* will be supplied with machinery of the newest and most approved kind, the engines being of the triple expansion type to indicate 100 H.P., by Messrs. Muir & Houston, engineers, Glasgow; and will also be provided with a suitable stretch of canvas, so that in favourable weather she may be adapted as a sailing yacht in place of being propelled by steam.

Gizeh.—On July 26th Messrs. Lobnitz & Co., Renfrew, launched a twin-screw hopper barge, built to the order of the Suez Canal Company. The barge, which is named the *Gizeh*, is 400 tons in measurement, and is in length 135 ft. by 25 ft. by 11 ft. 6 in. It will be propelled by two independent pair of compound engines, to indicate 300 H.P. The engines are being supplied by the builders.

Florida.—On August 3rd Messrs. John Cran & Co., launched a beautifully modelled steel steam launch, 60 ft. by 11 ft. 6 in. by 7 ft., to the order of T. A. Walker, Esq., Westminster, London, for service at Buenos Ayres new harbour work. She is to be fitted by the builders with compound surface condensing engines of 80 H.P. As she left the ways she was named the *Florida* by Miss Cran, daughter of the builder.

Benlarig.—On August 4th Messrs. Birrell, Stenhouse & Co., Dumbarton, launched a fine iron sailing ship of 1,700 tons register, built to the order of Messrs. Watson Brothers, of Glasgow, for their "Ben" Line. She is intended for the Eastern and Australian trades, and has been fitted with all the latest appliances for the handy and efficient working of the ship. Her bowsprit, lower top masts, and top-gallant masts are of steel, as well as all her yards, the topsail and top-gallant yards being double through-out, the only wood spar on board being a short spanker gaff. She has no reefs in any of her sails, these being so divided in size as to dispense with the usual necessity of reefing. She is also fitted with Shaw & Hastie's patent topsail and top-gallant halyard winches for all three masts. The ship has been built to Lloyd's highest grade, and is intended for a large carrier as well as a fast sailer. She is fitted with Emerson, Walker & Thompson Bros.' patent capstan windlass. As she started for the water she was named the *Benlarig*. After being launched she was towed to the builders' wharf, where she will be rigged and completed and ready to load her first cargo by the end of the month. Captain Nicholson, long and favourably known in the Eastern trade, will be in command.

Sokoto.—On August 4th Messrs. Russell & Co., Greenock and Port Glasgow, launched from their Kingston yard the large sailing ship *Sokoto*, of 2,175 tons net, and of the following dimensions: Length, 278 ft.; breadth, 48 ft.: and depth 24 ft. 6 in. She has been built to the order of G. M. Steeves, of Liverpool, for the ship Sokoto Company, Limited, Liverpool, and will be commanded by Captain W. B. Cross, late of the London ship *Lomond Stream*. During construction, the *Sokoto* was superintended by Captain James M'Gill, Liverpool, and is fitted with Emerson, Walker & Co.'s patent capstan windlass. Immediately after being launched she was towed to the Victoria Harbour, Greenock, where her equipment will be completed. The new vessel has been chartered to load at Glasgow for San Francisco.

Thistle.—On August 5th there was launched from the shipbuilding yard of W. S. Cumming, Blackhill Dock, Glasgow, a steel lighter 81 ft. by 12 ft. 6 in. by 5 ft., moulded, named the *Thistle*. The *Thistle* is intended for lighter work at Maraku, South America, and her scantlings have been made extra heavy for this purpose. She was shipped complete on the deck of the *Glen Huntly* in Glasgow Harbour.

Ayrshire.—On August 6th Messrs. Russell & Co. launched from their shipbuilding yard at Port Glasgow an iron sailing ship, built to the order of Messrs. Thomas Law and Co., of Glasgow, for their Shire Line. The new vessel has been built under special survey to Lloyd's highest class, and has all the latest and most approved appliances, including Emerson, Walker & Thompson Brothers', Limited, patent capstain windlass. Her dimensions are:—Length, 270 ft.; breadth, 40 ft.; depth of hold, 23 ft. 6 in.; tonnage, 1,750 tons nett. On leaving the ways she was named the *Ayrshire* by Miss Belle Muir, of New York, and when completed will load at Glasgow for San Francisco, and be under the command of Captain Miller, late of the *Peeblesshire*.

Baron Belhaven.—On August 8th Messrs. Robert Duncan and Co., shipbuilders, launched from their shipbuilding yard at Port Glasgow a steel screw steamer for Mr. Hugh Hogarth, of Ardrossan, of the following dimensions:—Length, 300 ft.; breadth, 40 ft.; depth, 24 ft.; 2,400 tons gross register; to carry 3,500 dead-weight. The new vessel is built to the highest class at Lloyd's under special survey, and has been fitted up with all the latest improvements, having a cellular double bottom capable of containing about 600 tons of water ballast. As she left the ways she was named *Baron Belhaven*. After launching, she was towed to Glasgow to receive her machinery, which is of the triple expansion type, with cylinders 22 in. by 35½ in. by 57 in. by 39 in. stroke, and steam will be supplied from two multitubular cylindrical boilers with a working pressure of 160 lbs. capable of developing about 2,000 H.P. Messrs. Duncan Stewart & Co., Glasgow, will supply the machinery.

Duchalburn.—On August 8th Messrs. Barclay, Curle & Co. (Limited) launched from their yard at Whiteinch a steel four-masted sailing ship, of 2,070 gross register tonnage, to the order of Messrs. Robert Shankland & Co. As she left the ways the new addition to the Shankland Line was named the *Duchalburn* by Miss Shaw-Stewart, daughter of Sir M. Shaw-Stewart, Bart. The new ship, which measures 287 ft. long, 42½ ft. broad, and 24 ft. deep, is fitted up with all latest improvements to ensure economy in working the vessel at sea, manipulating cargo, and comfort of officers and crew.

Moselle.—On August 9th Messrs. David J. Dunlop & Co., engineers and shipbuilders, Port Glasgow, launched from their yard, at high-water, a steel screw steam-tug named the *Moselle*. This vessel is similar in construction and design to the *Rhine*, built at the beginning of this year for the London and Tilbury Lighterage Company, Limited, of London, and is the third vessel completed by Messrs. Dunlop for the above company. The dimensions of the *Moselle* are as follows:—Length 70 ft.; breadth, 16 ft.; depth in hold, 9 ft. 4in.; and she has been built under Lloyd's special survey for 100 A class, with excessive strength for dock work. The vessel is being fitted by her builders with triple-expansion engines of 300 I.H.P. A direct steam windlass is fitted, also combined steam and hand steering gear to facilitate quick handling and manœuvring of the vessel in the docks and River Thames. On leaving the ways the ceremony of naming the vessel was gracefully performed by Miss Dunlop, Glasgow.

Mocooes.—On August 17th Messrs. Russell & Co. launched from their Kingston yard at Port-Glasgow a steel twin-screw steamer of the following particulars:—Length, 110 ft.; breadth, 19 ft. 6 in. on the load line, and 23 ft. at the deck; depth of hold of main deck, 7 ft.; and 7 ft. from the main deck to the shade deck. She is 92 tons net register, and has been specially constructed for the passenger trade and cattle-carrying purposes on the river Amazon. She will be supplied by Messrs. Kincaid and Co., Greenock, with compound surface condensing engines of 150 I.H.P. of 18 in. stroke. On leaving the ways she was named *Mocooes*. During construction she was superintended by Mr. Cuthbert, Glasgow.

Resolu.—On August 17th, Messrs. Lobnitz & Co., Renfrew, launched the *Resolu*, a screw steam tug, which has been built to the order of the Suez Canal Company. She measures 100 ft. by 18 ft. by 10 ft., and is being supplied by the builders with engines intended to indicate 220 H.P. The speed of the vessel is expected to be not less than 10½ knots per hour.

Britannia.—On August 18th, Messrs. Caird & Co., shipbuilders, Greenock, launched the steel screw-steamer *Britannia*, the sister ship of the *Victoria*, launched in May last, for the Peninsular and Oriental Steam Navigation Company. Her dimensions are: Length on load water line, 465 ft. 9 in.; breadth (moulded), 52 ft.; depth, 37 ft.; and gross tonnage, 6,267 tons. She is supplied with powerful engines on the triple-expansion principle, with all the latest improvements, and developing about 7,000 I.H.P. The diameters of cylinders are 40 in. 60 in. and 100 in. respectively, the length of stroke being 6 ft. in each. The engines are guaranteed to give her an ocean speed of 14½ knots per hour, and burning 110 tons net of coal per diem. The boilers are six in number (double-ended and constructed entirely of steel), having 36 furnaces, and adapted for a proof pressure of 300 lbs. per square inch. She has, besides, a three-furnaced auxilliary boiler for general purposes. Her water tanks structurally built in compartments, are designed for safety and for adjusting the trim of the vessel under varying conditions of loading or when passing over a bar. Being a large freight carrier, she will be equipped with all modern appliances for loading and discharge of cargo, including several hydraulic hoists and cranes by Sir William Armstrong & Co. With regard to her passenger accommodation, she is designed to carry 154 first-class saloon passengers, 156 second-class saloon, and 460 third-class passengers. The structural designs and general arrangements of the vessel have passed the Director of Naval Construction, and her name has accordingly been placed on the Admiralty list for employment in case of need as a fast cruiser. In that connection she could carry 1,200 soldiers, and in case of national necessity she could accommodate on her main and lower decks 2,700 men.

Renee Rickmars.—On August 18th Messrs. Russell & Co. launched from their Kingston yard, Port Glasgow, the four

masted iron sailing barque, *Renee Rickmars*, of the following measurement:—Length, 282 ft. 6 in. in breadth, 40 ft. 6 in.; depth 24 ft. 6 in.; register tonnage, 2,080 tons. She is owned by a German firm of shipowners, and will be commanded by Captain Gennerick.

Warora.—On August 18th Messrs. Alexander Stephens & Sons launched from their shipbuilding and engineering works at Linthouse a steel screw steamer 350 ft. long, 47 ft. beam, and 28½ ft. deep and about 4,000 tons gross, for the British India Steam Navigation Company. The vessel was named the *Warora* by Miss Polson, West Mount, Paisley. The *Warora* is a sister ship to the *Wardha* launched by the Messrs. Stephens last month, for the same company, and fully described at the time. The *Warora* has been built under Lloyd's and Board of Trade inspection for the highest class. She has a deadweight carrying capacity of about 5,000 tons, and throughout the vessel is fitted out in a superior manner, with all the most modern improvements for the efficient and expeditious working of ship and cargo. Very superior accommodation is provided for first and second class passengers and for officers and crew. The vessel is fitted throughout with a complete installation of electric lighting. The Engines made by Messrs Stephens, and fitted on board before launching, are of the most improved triple-expansion type, having cylinders 25 in., 41 in., and 67 in. by 48 in. stroke, steam being supplied by two large double-ended boilers suitable for a working pressure of 160 lbs.

Jelunga.—On August 22nd Messrs, William Denny & Brothers, Dumbarton, launched from their yard a steel-built steamship of the following builders' dimensions:—410 ft. by 48 ft. by 32 ft. deep, gross tonnage 5,200. This ship will have first, second, and third class passenger accommodation, and be fitted by Messrs. Denny & Co. with powerful quadruple expansion engines, also with hydraulic derricks by Messrs. Brown Brothers, Rosebank Ironworks, Edinburgh, placed on the masts.

King Arthur.—On August 22nd a square-rigged three-masted ship was launched from the Caledon Shipbuilding Yard, Dundee, for Messrs. Walker & Co., Glasgow. The vessel is 1,650 tons register, and was christened *King Arthur* by Mrs. Gibbs, Glasgow. Her dimensions are:—Length, 258 ft. 8 in.; breadth, 38 ft. 2 in.; and depth, 23 ft. 3 in.

Santanna.—On August 22nd Messrs. Scott & Co., Greenock launched a steel screw yacht of the following dimensions:—length 90 ft.; breadth, 24 ft.; depth, 15¼ ft.; and of 510 tons yacht measurement. The yacht, which was named the *Santanna*, is the order of Mr. Louis Prat, Marseilles, and has been built to the highest class Bureau Veritas. She will be fitted with triple expansion engines by the builders.

Gairloch.—On August 23rd Messrs. Alexander Stephen and Sons launched from their shipbuilding and engineering works, at Linthouse, a fine steel screw steamer, 282 ft. long, 37 ft. beam, 20½ ft. deep, and measuring about 2,350 tons gross, built to the order of Messrs. James Gardiner and Co., Glasgow. The vessel has been constructed under special survey of Lloyd's, to their highest class 100 A1. She has long raised quarter deck, with short poop aft, long bridge deck extending to foremast, and topgallant forecastle forward. The poop aft contains saloon, captains' room, and spare rooms, fitted up in a comfortable manner. Officers and engineers are berthed under bridge deck at after end, while seamen and firemen are located at fore end of bridge. The vessel has double bottom on cellular principal for water ballast, and is fitted throughout with all the latest and most approved appliances for the rapid and effective handling of ship and cargo, including steam and hand steering gear, steam winches, steam windlass and patent anchors hauling up into hawsepipes. The engines, which were fitted on board before launching, are of the most improved triple-expansion type, having cylinders 21 in. 83 in. and 54 in. diameter by 42 in. stroke, with double-ended boiler of ample size, suitable of 160 lbs. working pressure. As the vessel left the ways she was named the *Gairloch* by Miss Gardiner, Grosvenor Crescent, Glasgow.

Screw Steam Tug.—On August the 23rd Messrs. Lobnitz and Co., shipbuilders, Renfrew, launched from their yard a screw steam tug, built to the order of the Suez Canal Company. The dimensions of the tug are:—Length, 100 ft.; breadth, 18 ft.; and depth, 10 ft. The engines, which have been also constructed by Messrs. Lobnitz & Co., are to indicate 220 H.P., and it is expected that the speed of the vessel will be 10½ knots per hour.

Wybia.—On August 25th there was launched from the shipbuilding yard of Messrs. Scott & Co., Bewling, a handsomely modelled steel screw-tug 106 ft. by 10 ft., by 10 ft. 5 in., moulded for the Tasmanian Government, and to be employed at the port of Launceston. The vessel has been built considerably in excess of Lloyd's requirements for 100 A1 class, has Board of Trade certificate for passengers, and is fitted with part double bottom on the girder principle for water ballast, Alley & Maclellan's Sentinel steam steering-gear, Clarke, Chapman & Co.'s steam windlass, Linkleters patent disconnecting gear for lifeboat, and all the latest improvements. The vessel has been contracted for by Messrs. Ross & Duncan, Whitfield Works, Govan, who supply the engines, which are on the compound surface-condensing principle with large boiler power, and a high rate of speed is expected.

LAUNCHES.—Irish.

Pioneer.—On August 20th a schooner named the *Pioneer*, was launched from Messrs. M'Ilwaine and Lewis's yard, Belfast. The *Pioneer* is 73 ft. 4 in. long, 19 ft. broad, and 10 ft. deep; tonnage registered, 75. Mr. James M'Donnell, Portaferry, is the owner.

Steel Steamer.—On August 20th Messrs. Harland and Wolff launched from their shipbuilding yard, Queen's Island, Belfast, a steel steamer built for the London and North-Western Railway Company. The vessel is intended for the cattle service between Holyhead and the North Wall. The gross registered tonnage is 900; I.H.P., 1,800; Length, 300 ft; breadth, 33 ft. The steamer is fitted with all the most recent improvements, and is expected to attain a high rate of speed. There was no ceremony of christening at the launch, the name of the new vessel not having been selected. The steamer is propelled by two pairs of separate triple-expansion screw engines. The entire outfit will be supplied by Messrs. Harland and Wolff.

LAUNCH.—German.

Frigga.—On July 27th a large steel passenger steamer was launched by the Flensburg Shipbuilding Company in Flensburg, for the Deutsche Dampfschiffsrhederei, in Hamburg. This steamer is built to British Lloyd's 100 A1 and Bureau Veritas first division third rule of steel, from Mr. Fried. Krupp, in Essen. She will be a first-class passenger steamer, and one of the finest in the fleet. The dimensions are, length 302 ft., breadth, 36 ft. 6 in., depth amidship, 25 ft. 2 in. The triple expansion engines, which are built by the Flensburg Shipbuilding Co., was put into the ship directly after launching. Leaving the ways the vessel was named *Frigga*, by Miss Martha Schmidt, daughter of Mr. F. G. Schmidt, who is chairman of the Deutsche Dampfschiffsrhederei, in Hamburg.

TRIAL TRIPS.

Virgilia.—On June 30th a new iron screw steamer, built by the Flensburg Shipbuilding Company for the Hamburg Pacific Line, made her trial trip in the Flensburg Bay. This vessel is built to first division of Bureau Veritas of English iron. She is spardecked, and has the following dimensions:—Length, 291 ft.; breadth, 35 ft. 6 in.; depth, 26 ft. 5 in. The cabin is arranged in a deckhouse amidship, and accomodates 25 first class passengers. The saloon is highly finished and elegant, four entrance doors to the deck and ample ventilation makes the saloon cool in the hot climate. On the afterdeck is arranged a smoking saloon in a teak house. On top of the deckhouse amidships is a large promenade deck, with comfortable seats. The space between main and spar deck is arranged for emigrants. All steam winches, steam windlass, steam steering gear, are from Messrs. Clarke, Chapman and Parson. The engines, which are built by the Flensburg Shipbuilding Company, after the newest construction of triple-expansion, worked extremely smooth, and indicated 1,450 H.P., and a speed of 13·5 knots, to the greatest satisfaction of the owners, Mr. A. Kirsten, Hamburg, who again gave a new order for another steamer of larger dimensions, to be built of steel.

Charters Tower.—On July 25th the new steel screw steamer *Charters Tower*, built by Messrs. John Readhead & Co., West Docks, South Shields, to the order of Messrs. F. Stumore & Co., London, was taken to sea on her trial trip. Her dimensions are: 300 ft. in length, 40 ft. breadth, and 25½ ft. depth. She is classed 100 A1 at Lloyd's, under special survey, and has three decks, with bridge over engine and boiler space, a long cargo poop and topgallant forecastle. She is built on the cellular bottom

principle, and schooner rigged. Her engines, also built by Messrs. J. Readhead & Co., are of the triple expansion type. The machinery worked continuously during the four hours' trial, without the slightest hitch, at 75 revolutions, and were particularly noticed for their great steadiness. The power developed by the engines was 1,212 I.H.P. The engines are supplied with steam by two single-ended steel boilers, and, with extremely easy firing, the full pressure was easily maintained. The engine department is also furnished with Gilmour's patent feed water heater and patent evaporator. The speed on the measured mile, after a series of runs, was ascertained to be 11½ knots per hour.

Arancana.—On July 29th the steel screw passenger tug *Arancana*, 40 ft. by 8 ft. 4 in. by 6 ft., moulded, recently launched by W. S. Cumming, Blackhill Dock, Glasgow, went down the river on her trial trip. The engines, which are of the high pressure type, having a pair of cylinders 6½ in. diameter, with steel return tube boiler, and which have been fitted by Messrs. Lees, Anderson & Co., Glasgow, to whose order the vessel has been built, worked smoothly and easily during the whole of the trial, and gave every satisfaction. On the average of a number of runs on the mile a speed of nine miles was obtained, which was considered highly satisfactory. After the trial the *Arancana* went off under steam for Liverpool, where she was shipped for Chili, South America, on board one of the Pacific Mail Company's steamers.

Linda.—On July 30th the new steel screw-steamer *Linda*, built by the Tyne Iron Shipbuilding Company, Limited, of Willington Quay, was taken to sea for her trial trip. The vessel is of the following dimensions:—Length, 290 feet; breadth, 40 feet; depth, moulded, 27 feet; and is fitted with triple-expansion engines by Messrs. Wigham, Richardson & Co., of Newcastle, being respectively 24, 37, and 62 inches in diameter, and the stroke being 42 inches. Two large boilers working at 150 lbs. pressure supply the steam. The vessel has been built to the order of Messrs. Hunting & Pattison, of London and Newcastle, under special survey for Lloyd's 100 A1 class; is strengthened in excess of Lloyd's requirements, and is fitted with water ballast in cellular double bottom, extending right fore and aft. Her speed, as ascertained by the trial runs, averaged nearly 12 knots.

Galgo.—On August 6th the steel screw tug *Galgo*, built by Messrs. Ross & Duncan, Glasgow, went down the river on her trial trip. She is 88 ft. long by 17 ft. beam by 9 ft. deep, fitted with compound surface condensing engines of the most modern type, and is classed 100 A1 at Lloyds. The trial of speed was made on the Gareloch knot, when the engines indicated about 800 H.P., and propelled the vessel at a true mean speed of 12·09 miles per hour. Off Hunter's Quay the centrifugal pumps, which are capable of discharging about 600 tons per hour, were tried. The salvage towing gear and appliances makes the vessel a very complete one of her class. The owners were represented by Messrs. Caverley & Westray, London, and Captain Beaton, their inspector, and the vessel and her machinery gave complete satisfaction.

Ramapoora.—On August 10th the official trial of the British India Company's new paddle-steamer *Ramapoora* took place, and was eminently successful. This vessel has been constructed by Messrs. A. & J. Inglis for this company's mail and passenger service between Rangoon and Moulmein, and has to combine the qualities of a sea-going vessel and a river steamer of limited draught. Her capacity for dead-weight cargo is 400 tons on a draught of 9 ft. 6 in., and with that weight on board she will have a speed of over 14 knots. On the trial, when loaded with 215 tons, which will be her average loading in daily service, her speed was 16·186 knots, and this was easily maintained. The *Ramapoora* is fitted with machinery of a novel type, having three diagonal cylinders, 29, 47, and 70 inches, with 6½ in. stroke. The working pressure is 160 lbs.

Elettrico.—On August 11th this fine steamer, recently launched by Messrs. Alex. Stephen & Sons for the Navigazione Generale Italiana, of Rome, for their mail and passenger service between Naples and Palermo, completed her trial trips on the measured mile. She made an average speed of 16·4 knots with forced draught, and 15·9 knots with natural draught; and over a 200 knot run at sea. She maintained an average speed of 15·4 knots with natural draught, thus considerably exceeding the contract speed while burning ordinary Scotch coal, and even without using the provision for forced draught. The style and fittings of the vessel were pretty fully described at the time of the launch, and need not be again referred to; but this steamer will do credit to Clyde shipbuilding, and will be a noteworthy addition to the splendid fleet of her owners.

Grace Darling.—On August 12th the steel steam yacht *Grace Darling*, built by Messrs. Fleming & Ferguson, Paisley, went down the river Clyde on her official trial. She attained a mean speed on the measured distance of 14 miles per hour, which was considered highly satisfactory. Her dimensions are:—Length over all, 154 ft.; breadth, 19 ft. 6 in.; depth, 11 ft.; class, 100A at Lloyd's. This yacht is the second that has been built having quadruple expansion engines, the *Phœnix*, built by the same firm, being the first. The cylinders of the *Grace Darling* are 10 in., 14 in., 20 in., and 28 in. in diameter, and indicate 400 H.P., with a boiler pressure of 200 lb. per square inch, and a consumpt of 4 cwt. per hour. The yacht is fitted with incandescent electric light throughout, and with Darling's patent evaporating and distilling apparatus, which utilizes waste heat in funnel. This apparatus works most satisfactorily, and makes an ample supply of fresh water for use on board, besides making up any losses that may occur in boiler. The yacht has been purchased by Mr. Carbery Evans, of Hatley Park, Cambridgeshire, and left for Portsmouth immediately after trial and adjustment.

Queen Marfisa.—On August 15th the yacht *Queen Marfisa* went for her trial trip in Stokes Bay. She has been built by Messrs. W. White & Sons, of Cowes, for Mr. George Beer, from designs by Mr. Dixon Kemp. The mean results of speed on the mile were 11·24 knots an hour, from 116 revolutions of the propellor, which gave a slip of less than 7 per cent. The dimensions &c. of the yacht are:—Length over all, 136 ft. 6 in.; length on deck, stem to stern post, 118 ft.; length on load water-line, 112 ft.; beam extreme, 17 ft.; draught of water, 9 ft. 6 in.; Thames tons 160; displacement 175 tons.

Victoria.—On August 17th was run a very successful trial of the screw tug *Victoria*, built by Edward Finch & Co. (Limited), of Chepstow, for the Brazilian Coal Company (Limited), Cardiff. Her dimensions are:—Length, 90 ft.; breadth, 17 ft. 6 in. and 8 ft. 9 in depth of hold: having compound surface condensing engine, 16 in. and 30 in. and 22 in. stroke, with a boiler designed for a working pressure of 100 lbs. per square inch. She steamed down channel for some hours, averaging 11½ knots per hour, after which she entered Cardiff, from which port she sailed on 22nd inst. for Rio de Janerio, where she will be employed, and for which service the is specially designed, and fitted with teak decks, &c., and covered with a permanent awning.

Mexican.—On August 19th, the *Mexican* went out for her trial trip at Stokes Bay. The Royal Mail steamer *Mexican*, built by Mr. James Laing, Deptford Yard, Sunderland, and engined by Mr. George Clark, Southwick Engine Works, Sunderland, for the Union Steamship Company's Cape of Good Hope mail service, has had her engines converted from the compound to the tri-compound system by Messrs. T. Richardson & Sons, of Hartlepool, and has been supplied with new boilers working at a pressure of 160 lbs. per square inch. The diameters of the new cylinders are 36 in., 58 in., and 94 in. respectively; the length of stroke 54 in. A distinguished party was, through the courtesy of the owners, invited to witness the vessel's performance, there being present, in addition to Mr. Evans, the deputy chairman of the company, Mr. Hart, the secretary, and a number of the directors; Messrs. B. Martell, W. Parker, and H. J. Cornish, of Lloyd's Register; T. Richardson, jun., of Hartlepool; T. Oswald, Southampton; J. Bowers, superintending engineer, Southampton; and others interested in the building of steamships and the developments that are daily taking place in marine engineering. The vessel attained a mean speed of 15 knots per hour, and indicated 4,549 H.P., her engines working at 72 revolutions per minute, with a steam pressure of 160 lbs. to the square inch. This shows an increase in speed of 1·15 knots per hour, and an additional 1,179 I.H.P., as compared with the *Mexican's* trial trip with the compound engines. The adoption of the triple-expansion engines will add greatly to the comfort of passengers, through the decreased vibration, while the economised consumption of coal will be advantageous to the proprietors. The *Mexican* is the fourth of the Union Company's mail steamers which has been converted to the new system, and it is confidently anticipated that the result will be as satisfactory as in the case of the three others, viz., *Spartan*, *Athenian*, *Trojan*. The *Moor* is about to have her engines tripled, and will be followed on her completion by the *Tartar*. The intercolonial steamers *Anglican* and *African* are also fitted with triple-expansion engines.

Gulf of Aden.—The s.s. *Gulf of Aden*, built by Messrs. Raylton, Dixon & Co., of Middlesboro', for the Greenock Steamship Company Limited, of Greenock, and sister vessel to the s.s. *Gulf of Trinidad*, launched by the same firm for the same owners on August 20th

has just completed loading a cargo of rails manufactured by Messrs. Bolckow, Vaughan & Co., for the first Chinese Railway and sailed for that country after a most successful trial trip, making an average speed of 12 knots loaded on the measured mile. She is built on three deck rule, to the highest class of Lloyd's, of the following dimensions:—Length, 312 ft. 6 in., by 40 ft. by 25 ft. 2½ in, and will carry 3,500 tons. Has water ballast in chambers. Long poop, bridge and forecastle extending almost the whole length, and every convenience up to the most modern style for a first-class merchant steamer. In addition she is fitted with handsome saloon, and cabins for 30 first-class passengers. She has triple expansion engines of 350 N.H.P., by Messrs. Blair & Co., Limited, of Stockton.

Correspondence.

*[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—*ED. M. E.]

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—I am sorry to see so much quibble with your correspondents mari e engineers, about things which really does not concern them at present, such as "taking masters' and mates' duties, tallying cargo, chemistry, die in your hammocks," &c., &c. All such points can be proposed and papers read at general meetings of the society, and could be approved of in the usual way. More urgent grievances can be brought forward which must—that is the word—must be altered as the rating of ships 99 H.P., when it is well-known they are perhaps 120 H.P., to do or undo a chief engineer out of a berth, and place only one certificated man in a ship where there ought to be at least two certificated men and perhaps three. It's a disgrace to all concerned. What advantage is it for a man holding a second class certificate to study pay fees and pass his examination for a first class certificate? None, only to throw himself out of employment. This 99 H.P. should be stopped, and at once. The Board of Trade seem to help a swindle, knowing full well it's done to do a chief engineer out of a berth, or for the shipowner to get off paying two certificated men, which I maintain is a swindle on the shipping laws. Again, every man who is entrusted with a watch ought to have a certificate, whether he is third, fourth, or fifth, no matter what he is; if he is shipped as an engineer he should have a qualification as such from the Board of Trade, the examinations commencing at sixth. These classes should be created at once, not only for public safety, but for professional rights, and any man who is appointed as an engineer, and who is legally not an engineer, with no qualification or certificate, the same penalty should be enforced as applies to engineers holding certificates, and on the owners of the vessel for shipping him. Again, certificates are granted too freely, there should be longer stages of experience which goes far more in the repairing of a breakdown than all the chemistry, &c., &c., or, the extra, extra first, or a dozen extras.

A word about the title of the "Union,"—spare the mark. Shakespeare says, "What's in a name?" If he lived in these days he would say everything is in a name. The title has everything to do with it, its striking both legally and morally, and must say I do not like the title "Union," and I have not met one out of a score that does like the title, on the contrary, no one likes it; and I have suggested to many who appears to concur with me that "Institute" or "Society" would be far more suitable, as it would blend with the Australian Institute of Marine Engineers, and which I hope to see amalgamated with our British Institution. There is no other society or body of men who can show a legal right to be called engineers, so why not call it the British Institute of Marine Certificated Engineers; this would be a title stamping the society with a qualification that no other society in the world can boast of, and would not infringe on any other; but of course the society or institute should debar any but certificated men from entering. The initial letters would be B.I.M.C.E. Trusting I have not encroached on too much space,

I am, Sir, yours truly,

23rd July 1887 LITLE. 99 P.

To the Editor of THE MARINE ENGINEER:

SIR,—There having been considerable doubt in the minds of sea-going members of the Amalgamated Society of Engineers, and many enquiries made by them, as to whether they would be allowed to join the Marine Engineers' Union, it will serve to remove that doubt and answer these enquiries if you will kindly permit me to inform your readers that the matter has been brought before the council of that society, with the result that a letter has been received by me from their General Secretary, of which the following is a copy:—

"Amalgamated Society of Engineers,
"89, Stamford Street, London, S.E.,
"*26th July*, 1887.

"DEAR SIR,—As I promised to lay your Rules, &c., before our Council, I now beg to inform you that that body decided to insert a notice in our monthly report that any of our members seagoing engineers may join the Marine Engineers' Union, as there is nothing inconsistent in the rules, or in opposition to our own rules.

"I am, yours truly,
"(Signed) ROBT. AUSTIN."

Considering that one result of the operations of the Union will be to restore to their proper places on board ship a large number of engineers who are now unemployed, through these places being filled by men who have not learned any of the mechanical handicrafts, and consequently have no claim to them, and as this change will relieve the Amalgamated of a serious drain upon its funds, its members may be congratulated upon the action of their Council in so promptly seizing a favourable opportunity for lightening their financial burdens.

The co-operation of these kindred societies cannot fail to be productive of good to both, and while the elder still guards the interests of our brethren on shore, the younger will have full scope for its fresh useful energies in watching over the interests of those whose daily bread has to be earned upon the briny deep.

Our members are now to be found in all parts of the world, and one of our General Committee, who has lately returned from China, reports that the merits of the Union have been well discussed by the engineers trading out there. He says that feeling the isolated position of their local societies, and their comparative inability to carry out any general movement for their benefit, some of their leading men have asked him to enquire whether the Union would not extend its operations to China and open branches there.

Being ever ready to respond to such a call, the Executive have promptly made the necessary arrangements, and our committee-man leaves again in a day or two for the Flowery Land, with the necessary documents, and full authority to enrol members and open branches in Singapore, Hong Kong, and Shanghai, if the engineers there still desire to have them.

The correspondence daily received at this office shows that our brethren are becoming more and more interested in the Union as the weeks pass by, and the numerous enquiries they make regarding its proceedings may well be regarded as evidences of their interest. It is always a pleasure to me to reply either personally or by letter to these enquiries; but I would strongly advise all engineers who are desirous of knowing what the Union is, and what it purposes to accomplish, to send for a copy of its circular, and to procure the numbers of this journal from April to August, inclusive, wherein they will find an account of what has already been done, and ample information as to the schemes that are now in preparation. One of the most important of these will be that affecting the *practical* education of engineers, and the granting of certificates for competency. This scheme is not yet ready for publication, as it comprises so many details that have to be discussed; but I may mention that it will probably include proposals such as: That no engineer should be allowed to go to sea unless he has served a regular apprenticeship, and then passed an examination in *workmanship* and practical knowledge; that he should serve a year on the ship's articles as assistant engineer; that he should then pass a Board of Trade *educational* examination and receive a third class certificate; that he should serve two years with this and then pass for second class and after serving two years more he may then pass for first.

The action of foreign governments in discharging or excluding British engineers from their merchant services is now engaging the attention of the executive, and they desire me to say that they will feel obliged to any of your readers who will forward to me authenticated reports of such cases coming under their observation as may bear upon this question. The Union continues to progress steadily both in numbers and influence, and as the

[illegible] already in working order have shown how much can be [illegible] this agency it is to be hoped that those districts [illegible] are not opened will realise the fact that they are [illegible] neighbour, and come at once to the front with [illegible] be included in the ranks of those who are so laudably [illegible] and improve our profession.

[illegible] thanks for your continued courtesy,

I remain yours, &c.,

THE HONORARY CHIEF SECRETARY,

Marine Engineers' Union.

[illegible] Tower Hill, London, E., 21st August, 1887.

[illegible] of The Marine Engineer.

[illegible] of your readers inform me if any steamer has [illegible] direct to Australia or New Zealand without [illegible] place or port. If so can they name the [illegible] of voyage.

I am yours truly,

H. STOKER.

[illegible], 1887.

[illegible] of The Marine Engineer.

[illegible] to thank, through your columns, the eighteen [illegible] engineers who have written me so [illegible] recent letter.

[illegible] understand if the certificated ship-[illegible] steam, why the certificated marine [illegible] from a pass in navigation. I confess [illegible] certificates will make the ship-[illegible], or marine engineer a more [illegible] heads than I pretend to possess [illegible] arrive at greater efficiency in their [illegible] the pass in navigation remain [illegible] become productive of good to us as [illegible] as a body, doubtless in our own [illegible] the option.

[illegible] high-pressure, when big books are [illegible] skilful impotence results from [illegible]'s" letter), men aspire to a larger [illegible] the *bevel* is of most importance, [illegible] and chisel men are daily more and [illegible] unmanageable products of modern [illegible] naval tomfooleries, which, should [illegible] more injury to the defenders [illegible]

[illegible] our brotherhood more in "touch" [illegible]fulness, and kindly knowledge [illegible]tiousness, feeling something [illegible] to the profession to which we [illegible] per months in pay, and hope [illegible] down to accept the fact we are all [illegible] interest and object, *the well-being of* [illegible] rating as engineer officers carries [illegible] large responsibilities, to hold [illegible], the senior officer acting as [illegible] duty and interest in other officers [illegible], sinking all petty jealousies [illegible]; this is what I would explain [illegible] Chief Secretary (whose activity [illegible] that in the short space of four [illegible] branches in principle seaports) [illegible] continues doing his very utmost [illegible] of life, to some *the question* [illegible] of us that is not the primary [illegible] brotherhood will be brought to [illegible] result in benefits to the former

[illegible] of blood shall break,
[illegible] evermore."

[illegible] have all read Æsop or Fontaine, [illegible] sons, and the bundle of sticks." [illegible] of the States of America, "Many [illegible] never make a barrel." To-day, [illegible] this precept in American States [illegible] of late in Marine Engineer [illegible] has much sound grit of the right [illegible] *thousand unconnected states.* The [illegible] Chief Secretary, who I have not [illegible], in a self-denying manner, offers to become, and is becoming, the "hoop" to the hitherto *unconnected states*, little doubt can be entertained once the barrel is perfected *it will roll* and be marked "The Marine Engineers Union," deserving the motto: "l'Union fait la force," "Quis separabit" (Union makes strength, who shall separate).

I have the honour to be, yours truly,

RICHARD A. JAMES COPE,

Working Marine Engineer, No. 20,517.

Decorated Order of Leopold, 2nd class.

Sas-les-Ostende (Belgium), *8th August*, 1887.

STEAM DOMES ON MARINE BOILERS.

To the Editor of The Marine Engineer.

Sir,—Fitting of steam domes on marine boilers for ordinary compound engines seems to have been the rule, whereas boilers for the modern triple-expansion engines are, as far as I know, being made without them. It will interest me very much to know the true reason of this, and perhaps you, Sir, or some of your readers, will kindly explain it to me.

As for strength I think there is no more danger in putting a steam dome on a 150 lb. boiler than on a 80 lb. one, when in both cases every part is made strong enough to sustain the pressure.

If the getting of as dry steam, and as uniform as possible, are the objects of steam domes, I think they should be fitted in all cases. But if the object is to increase the steam room they are not necessary, as the increasing of diameter of boiler, although more expensive, will have the same effect, besides the advantage of increased area of water surface for evaporation, thereby reducing tendency of priming. But is not an internal steam pipe necessary in this case, and is it generally fitted?

I shall be very glad to get some information on these points.

I remain, Sir, yours obediently,

SUBSCRIBER.

Stavanger, *July*, 1887.

CERTIFICATED ENGINEERS IN STEAM YACHTS.

To the Editor of The Marine Engineer.

Sir,—I have read with great interest the letters written by "W. F. O.," and "Yacht Engineer," on the above subject, and, as one of the few who have obtained a certificate of competency with yachting time, I should like to state my experience. I think, Sir, that "W. F. O." is mistaken in supposing that "Yacht Engineer" alludes to "drivers" in his letter, as I do not know one of that fraternity in a steam yacht who holds a certificate of any sort, and I think it would be very hard indeed for a man of that class to obtain a certificate, judging from the reluctant way mechanics and myself have had their credentials received by the examiners. After shewing nine years in a fitting shop, and put in two years and one month at sea in steam yachts going to the Mediterranean, West Indies, and America, on putting in my papers at Basinghall Street I was much surprised to find them objected to because the time had not been put in on board merchant steamers. The examiners doubted whether in the two years and one month for which I put in discharges I had put in twelve months at sea counting the time going from one port to another; this, no doubt, is what "Yacht Engineer" means in the sentence "W. F. O." cannot understand.

Why does "W. F. O." call yachting engineers "drivers?" Mechanics holding extra first, and first and second class certificates, are they to be called "drivers" because they have berths in steam yachts?

I am, Sir, yours truly,

F. C. HAYES,

Engineer, s.s.y. *Lancashire Witch.*

To the Editor of The Marine Engineer.

Sir,—I much regret that my letter *re* certificated engineers in steam yachts has not been understood, and received in a somewhat more friendly spirit by your correspondent "W. F. O." I merely stated in as few words as I possibly could the result of my observations in the few years I have been connected with steam yachts, thinking they would be received with satisfaction by engineers in general and "W. F. O." in particular. I said, Sir, that, to a certain extent, I wished to contradict your correspondent's remarks; it being my impression after reading is

letter that he was not aware of the manner in which the Board of Trade examiners had lately received some of the candidates offering themselves for examination, after serving on board steam yachts. It is obvious, from his reply, that he is *not* aware of all that has transpired, for by stating in such marked terms his inability to understand my language he confesses that his knowledge of the subject is hardly what it should have been before writing his letter to the MARINE ENGINEER. Had I known this I should have added the words printed in italics to the part of my letter he complains of, it would then have read:—"For in several instances which has come under my notice, time lying up in harbour and cruising around the British coast, has been refused, and in one case *although the yacht was engaged on a foreign voyage, the examiners were not willing to allow the applicant any time the yacht had lain in harbour*, but only the time actually spent going from port to port. This will come as a surprise to your correspondent, especially when I say that the candidate I mentioned was a mechanic and *not* a driver, and that the other candidates I referred to were also mechanics. Since writing you in June last I have spoken to another engineer who has passed from a yacht, and he informed me that his papers were objected to on much the same score as in the case I cited—namely, that it was not fair to merchant service engineers to allow an engineer of a yacht to count the time his yacht had lain about in harbours on a foreign voyage, but only to time spent at sea, making passages from one port to another. Only some three or four months ago a mechanic, who had served on board yachts, had his papers refused altogether by an examiner at one of our principal ports, because the time had not been put in on board merchant steamers. Subsequently, I believe, he had to have an interview with a gentleman of very high standing in the Board of Trade before he was allowed to sit for examination. Surely, Sir, when examiners are getting so severe on mechanics, a "driver" ought to experience a rather warm reception on applying for a certificate, especially when, as "W. F. O." correctly says, three out of the four years' foreign service he would have to recommend him may have been spent in harbour. On that point your correspondent is quite right; but, knowing the way mechanics are received, I cannot conceive how "drivers" get through in such an easy manner as his letters suggest, and I am surprised that he passes by the other portion of my letter without making any comment. I am quite aware that, so far as the Board of Trade regulations are concerned, any one *can* go engineer of a steam yacht; but, as I pointed out, anyone does *not* go, and at several of the yachting centres on the Solent it is fast becoming an unwritten law that no one need apply for a berth on board a yacht who is not a qualified engineer. This recently has chiefly been attained by the quiet but firm and united efforts of the engineers themselves, amongst whom are many men of great experience in the merchant service—men who I am sure your correspondent would be proud to meet, and it will come as a surprise to many engineers who have read "W. F. O.'s" letters, to know that at Cowes, our greatest yachting resort, a "driver" who has obtained a certificate after serving four, or, for matter of that, fourteen years on board a yacht, is unknown!

In conclusion, Sir, let me assure "W. F. O." that I do not write animated by the slightest ill-feeling or desire to enter into a controversy. As the holder of a first-class certificate, obtained while serving in the merchant service, I am as anxious as he is for the welfare of our profession, and trust, as he knows of cases where "drivers" have obtained certificates, that he will present the petition he speaks of without delay. I shall be happy to assist him in any way I can, and feel sure he will say that I am perfectly justified in writing this letter—the last, I trust sir, you will be troubled with on this subject.—I am, Sir, yours obediently,

YACHT ENGINEER.

NEW ATLANTIC LINE.—It is proposed to establish another transatlantic steamship company at Hamburg for the service between the Elbe and New York. The undertaking is to be worked in connection with the shipping firm of August Bolten.

MESSRS. STREET & ELLIS have on exhibition at 93, Queen Victoria-Street, collapsible berths for emigrant ships. They can be quickly taken to pieces and stowed away in very small compass, and are so formed that there is no fear of breakage even if cargo is placed on the top of them. The cargo space of a returning emigrant ship is of course proportionately increased. They are at present being fitted up at Hull in the Wilson line of steamers for their Swedish and Norwegian traffic.

Miscellaneous.

CHIEF engineers Hugh Burstow and Charles Francis Hulford have been promoted to the rank of staff engineers of Her Majesty's fleet. Chief Engineer John Kimber and Engineer Benjamin Taylor have been placed on the retired list of their respective ranks.

DOCK ACCOMMODATION AT MELBOURNE.—The Melbourne Harbour Trust has decided to make an immediate commencement with a new dock in the West Melbourne Swamp. A plan prepared by Sir J. Coode and modified by Mr. Brady, chief engineer to the Harbour Trust, has been adopted.

THE First Lord of the Admiralty states that the present Board of Admiralty are of opinion that the dockyards should build the great bulk of the ships required for the navy, and this year out of thirteen ships of different types eleven have been, or will be, laid down in the dockyards.

COLLISIONS AT SEA.—At a recent meeting of the Paris Academy of Sciences, a paper was read on this subject by M. Jurien de la Gravière. In connection with the increasing number of disasters caused by preventable collisions, attention is directed to the practical measures recently proposed at various conferences by M. Riondel. Of these the most important are (1) that all steamers be required to follow one outward and another homeward route, in order to divide the present single stream of traffic into two parallel streams; (2) that a maximum velocity be determined for vessels navigating narrow straits in foggy weather; (3) that the lighting of the high seas be rendered more powerful, and brought more into harmony with present rates of speed; (4) that international maritime tribunals be established in order to adjudicate between vessels of different nationalities. The latter proposition has already been approved by the United States, and several Governments have consented to take part in the future International Conference to which the whole question must be referred.

THE CONSTRUCTION OF VESSELS IN COMPARTMENTS.—Mr. John Price, general manager of the Palmer's Shipbuilding and Iron Company, of Jarrow-on-Tyne, in the course of his evidence before the select committee of the House of Commons, on saving life at sea, said that he was formerly one of the chief surveyors for the Liverpool Registry of Shipping. As to the number of compartments into which a vessel should be subdivided, she would be practically safe to float if she had ten compartments and two were filled with water. In witness's opinion, a law to compel owners of cargo ships to have them with more compartments would harass the owners financially; but the increased cost of the compartments and bulkheads being made sufficient to keep the vessel afloat long enough for the boats to be resorted to would not harass financially the owners of passenger vessels. In the case of cargo vessels it would, however, necessitate increased steam appliances for loading and unloading. Witness considered that the existing regulations did not require the bulkheads to come up high enough. The height to which they came up might be increased so as to keep afloat a vessel that was rammed a longer time. It was difficult to say "long enough," as the circumstances of all collisions differed. It would certainly be practicable to subdivide the lower part of steamers carrying large numbers of passengers, for whom it would be impossible to provide personal exit by boats so as to make the vessel really a lifeboat. Witness did not advocate the engine and boiler space being divided, as that would tend to hamper the working of the engines. The increased subdivision need not practically take away from the passengers any real comforts or conveniences by reducing the size of the spaces, as the lower parts of passenger vessels were carefully used for food and sleeping purposes, the upper deck and saloons being resorted to at other times. In the case of cargo steamers, it had undoubtedly been proved that in proportion as the decks were protected by deck erections, such as poops, deck-bridge, and forecastle, the loss of life and vessels had largely decreased. With reference to rafts, witness thought that to a large extent they were a mistake. If made adequate to the requirements of the large number of people on board a crowded vessel, they would be practically unserviceable. It would be utterly impossible for such boats as the Isle of Man steamers to have boats sufficient to carry all the passengers. Such a vessel could not be constructed, but that was a question for constructors, and not for seamen to decide.

Obituary.

MR. WILLIAM HALL, SHIPBUILDER.

Mr. William Hall, Sen., Shipbuilder, Aberdeen, died at his residence in that town on the 9th inst., aged eighty-one years. In conjunction with his late brother, James Hall, the deceased distinguished himself in connection with the introduction of the "Aberdeen clippers," so famous in their day and generation. The father of the Messrs. Hall was a shipbuilder in a modest way, and with him his sons served the customary apprenticeship term as shipwrights. The deceased, after serving his time, went to sea for the period of three years, and on his return he and his brother went into partnership as shipbuilders. In 1846 they began the construction of clipper vessels, the schooner *Torrington* being sent by way of experiment to compete with the swift American vessels at that time monopolizing the China trade. The *Stornoway* and the *Chrysolite*, with lines as sharp as those of any American vessel, but of superior strength, were ordered soon after by Messrs. Jardine, Mathieson, & Co., which, though proving very fast for their size, were no match for the Americans. In 1853 Messrs. Hall built the *Cairngorm* of 938 tons, which proved equal in speed to any of her foreign competitors, and by delivering her cargo in superior order obtained a preference. Thereafter the Aberdeen vessels acquired a special reputation for speed and seaworthy qualities, beating the fastest American vessels on long voyages. They gradually obtained a complete ascendency in the China trade, until in turn they were supplemented by screw steamers. The late Mr. Hall was greatly esteemed by the inhabitants of Aberdeen and by a large circle of shipbuilders and engineers. He is survived by two sons who are partners in the Iron Steamship Building Co., of Hall, Russel, and Co., the modern outgrowth of the old firm.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from July 15th, to August 8th, 1887.

9935 J. R. Bell. Fittings for grab dredger.
9942 E. F. Wailes. Stern posts, frames and ships' rudders.
9959 J. T. Bucknill and A. J. Day. Barge.
9975 C. L. Tweedale. Propelling vessels.
9982 J. H. Martin. Propelling boats.
9987 J. T. Shipman. Steering torpedoes.
10018 C. Vincent. Boiler tube stopper.
10028 J. E. & J. Ford. Anchors.
10109 W. Cheshire. Buoys.
10119 Lake (A. Cook). Removing bilge water from ships, &c.
10251 E. Chatham. Propelling boats.
10256 G. Lowry and R. Wilby. Steam boilers.
10272 J. A. Yatman. Storm sails for ships.
10317 C. Pfaff. Rotary slide valves and valve gear.
10333 J. Edge. Steam engine governor.
10358 J. Dunn. Ships' davits.
10413 E. Lawson. Ships' berths.
10416 T. B. Heathorn. Steering, propelling, and retarding vessels.
10429 J. G. W. Fairbairn. Steam engine governors.
10465 C. D. Durnford. Spinnaker sail.
10501 J. Long. Ships.
10509 A. Reis. The employment of steam as a motive power.
10527 Chamberlin (H. Chamberlin). Sounder alarm.
10536 Sir W. Vavasour, Bart. Steam traps.
10547 G. E. Lanfranconi. Movable stage or bridge for use in loading ships.
10563 J. B. Merkl. Paddle propeller.
10581 G. Alexander. Internal boiler tube cutter and expander.
10605 W. Allan. Propelling torpedoes.
10617 J. G. W. Fairbairn. Stop and regulating valves.
10654 Gedge (The Leduc Tule Improvement Co.). Life preservers and rafts.
10660 F. Wiske. Steam cylinders.
10691 A. S. Savill. Steam cleanser.
10692 J. Nicholas and H. H. Fanshawe. Ordnance.
10714 W. Mills. Ships' davits.
10715 do. Chocks for ships' boats.
10737 E. F. Wailes. Stern frames and rudders.
10750 J. O'Kelly and B. A. Collins. Torpedoes.
10770 J. Gamgee and H. Fabian. Fluid pressure engines and pumps.
10790 J. Roots. Boats.
10817 Johnson (La Compagnie Anonyme des Forges de Châtillon et Commentry). Tempering armour plates.
10837 W. S. Winans. Ships' bulkhead doors.
10863 F. G. C. Weir. Supporting persons in water.
10866 C. A. de A. Basto. Motor.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

August 13th, 1887. Cockeram, W. H. Extra 1 C Hull.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

July 23rd, 1887.

Appleby, Harry.. 1C W. H'p'l
Barker, Wm. J.. 1C ,,
Beggan, John .. 1C Liverpool
Bowes, Alfred .. 2C W. H'p'l
Cooks, Charles .. 2C Cardiff
George, Thos. G. 2C ,,
Hewitt, Robert.. 2C W. H'p'l
Hodgson, Jos. R. 1C Cardiff
Hutchinson, W. A. 2C N. Shields
Johnson, Henry.. 1C Cardiff
Jones, William .. 2C ,,
Knight, A. H. .. 2C ,,
Marriott, Rob. L. 2C ,,
Martin, John .. 2C ,,
Martin, William .. 1C London
McPherson, A. F. 2C Glasgow
Peel, Alex. F. R. 1C W. H'p'l
Powell, Evan.... 2C Cardiff
Reid, James .... 1C Liverpool
Salmon, Edw. M. 2C ,,
Shaw, Jas. Henry 1C N. Shields
Short, William .. 1C Liverpool
Simpson, J. .... 1C Glasgow
Stewart, Johnstone 2C ,,
Wills, Charles .. 1C Liverpool
Wilson, Samuel.. 2C N. Shields

July 30th, 1887.

Anderson, Wm.. 1C Liverpool
Anderson, Wm.. 1C Sunderl'd
Bizzett, D. S.... 1C Liverpool
Bulger, Edward . 2C London
Clay, George.... 2C N. Shields
Fowler, John.... 2C Liverpool
Green, Albert .. 1C London
Green, Henry .. 1C Liverpool
Maddison, Wm.. 2C Sunderl'd
Marshall, Geo. M. 2C N. Shields
Martin, James .. 1C Liverpool
McGregor, W. B. 2C ,,
Mitchinson, Perry 2C Sunderl'd
Muir, Wm. .... 1C Liverpool
Parry, Fred T... 2C ,,
Procter, G. D. .. 2C Sunderl'd
Ryle, Alfred A. 2C N. Shields
Scott, William .. 2C Sunderl'd
Sims, John...... 2C London
Sudden, Alex. .. 2C Liverpool
Thorman, John R. 2C Sunderl'd
Wilkinson, J. G.. 2C N. Shields

August 6th, 1887.

Brown, J. McI... 2C Glasgow
Colqunoun, J. P. 2C ,,
Doughty, Samuel 1C N. Shields
Eadie, John W.. 2C Glasgow
Evitt, William .. 1C Greenock
Gemmell, James 1C ,,
Gordon, Joseph.. 1C Glasgow
Hague, James .. 1C London
Harrold, Foster.. 2C N. Shields
Hulme, David .. 2C London
Jeffery, William 2C N. Shields
Keenan, Ed. .... 1C London
McCance, Andrew 1C Greenock
McCulloch, Allan 1C Glasgow
McDowall, Wm.. 2C ,,
Patrick, Alex. .. 2C ,,
Paxton, John.... 1C London
Quillish, John .. 1C Liverpool
Smith, Robert S. 2C London
Smithson, A. E.. 1C N. Shields
Sunner, John H. 1C Greenock
Tindall, Andrew 2C Glasgow
Tyrrel, Rich. J... 2C London
Watson, John .. 2C Liverpool

August 13th, 1887.

Ashcroft, Hy. H. 1C Liverpool
Baxter, Samuel.. 2C Leith
Brown, James .. 1C ,,
Brown, Jno. Jas. 1C W. H'p'l
Burnett, Samuel 2C ,,
Carmicheel, F... 2C Glasgow
Crawford, James 2C ,,
Croll, George.... 2C Leith
Cummins, T. D... 2C N. Shields
Duguis, Hy. Jas. 2C ,,
Ertershank, D... 1C Leith
Gibson, John.... 1C ,,
Hall, Frederick.. 1C N. Shields
Hayes, Thomas.. 2C Liverpool
Hinton, Alex. .. 2C Leith
Hobson, Wm. E. 2C N. Shields
Hodgson, John.. 2C W. H'p'l
Inglis, Robert .. 1C London
Kellard, George.. 1C ,,
Kelly, Alfred S.. 2C ,,
Lessels, Jos. A.. 1C Leith
Lillie, Richard K. 2C ,,
Pirrie, Alexander 1C London
Proudlock, J. G. 1C N. Shields
Richardson, J. B. 1C Leith
Rogers, Jas. Jno. 2C ,,
Rossiter, John .. 1C London
Rushton, H .... 1C W. H'p'l
Sillars, Hugh .. 1C Leith
Snowdon, Jas. J. 2C W. H'p'l
Walker, John C. 2C Leith
Weir, William .. 1C ,,
Williams, James 2C Liverpool
Wilson, John W. 2C N. Shields

The Marine Engineer.

LONDON, OCTOBER 1, 1887.

EDITORIAL NOTES.

THERE is much interest at present in political circles as to the rumoured successful termination of negotiations between England and France for the neutralization of the Suez Canal. It is obvious that this Canal forms a vital highway for the enormous maritime commerce of Great Britain with the Pacific Ocean, and as the Suez Canal forms also the shortest route by some thousands of miles to India, the guaranteed passage of our troopships and vessels of war in case of any sudden difficulty from an internal or external foe in India would be of vital importance to this country. Up to the present England has endeavoured to ensure this for herself by practical military occupation of the country. But this is an arrangement that neither suits the foreign policy of Great Britain nor is it likely to remain unassailed by other interested European countries. If a substantial and reliable guarantee of neutrality for the Suez Canal can be agreed to in the sense that both mercantile and war vessels are to be free at any time to pass through the Suez Canal, this is obviously all that we want, and we could well maintain our own interests in the command of the seas by stationing a fleet outside the neutral zone at either or both ends of the Canal, which would practically block access for any foreign hostile power just as well as if we had absolute occupation of the Canal itself. We should imagine that when this much vexed question has been so settled, the commercial direction of the Canal will be able to devote more undivided attention to the better accommodation and rapidity of transit of the enormous commercial marine which is constantly passing through this Canal. The application of electric lights to the Canal will materially aid in this direction, as affording greater security of transit during the hours of darkness, and when the proposed widening has been fully carried out the result will be very beneficial to the shipping trades. It is a pity that a question like this which creates much heart-burning between two neighbouring nations should be allowed to stand unsettled so long, and we are glad to believe that a solution, dealing fairly with all interests in the matter, is now about to be arrived at.

DOCK speculations are proverbially disappointing, and there have been many gigantic undertakings in the construction of docks lately which, we fear, have far from realized the expectations of their investors. We regret to say that we have heard latterly that the Preston Docks and Ribble improvements are also proving somewhat unsatisfactory. The actual costs of the works are as usual much in excess of the estimated amount; it is said they are likely to prove double. In this case it is not so much any unexpected difficulty in the construction of the docks as in obtaining access to them, and a bar of sand extending some five miles out seems to offer a serious obstruction of the access to the docks, unless a suitable ship channel is made through this beach and kept open. Now there is nothing more troublesome and expensive than endeavouring to maintain a channel where nature desires to silt it up, though there is no doubt that with dredging or other works a channel may be made and kept open anywhere and through anything, such a "dead horse" is likely to convert what might have been a profitable undertaking into one at least very much burdened with capital expenditure and heavy maintenance of costs. As it seems, however, that a deep water channel existed some years back, by which access could have been obtained to the docks in question, we may hope that by a proper investigation of prevailing currents or proper control of the outflow of the Ribble, a cheap ship channel may be kept open by natural means without constant dredging.

IF the Clyde could always ensure so good a month as they show for the month of August there could be no doubt as to the enormous revival of trade in shipbuilding. The vessels launched during that month were nineteen in number, having an aggregate tonnage of about 36,000 tons, which we take it is largely in excess of any month for the past three years. This result, however, is we fear only exceptional, or at any rate must not be taken to indicate anything more than a fair average output, as we find that although the output of the Greenock and Port Glasgow yards are very heavy in the month of August, they did not launch a single ton in the month of July. Of the total tonnage launched, fourteen vessels were steamers and five were sailing ships. Of the firms who substantially contributed to the result, we may mention Messrs. Caird & Co., Messrs. Russell & Co., Messrs. A. Stephens & Sons, and Messrs. Denny Bros. From what we hear of the work in hand at present this is not as yet so satisfactory as might be wished, but we think it likely that large orders may be placed in the course of the next month or two, two Glasgow Companies being either just in the market, or about to issue specifi-

cations with many other good enquiries. We think that by this time losses and other causes of reduction have pretty well absorbed the unemployed tonnage, so much of which has latterly been lying about unused, and consequently that we are likely to see a renewal of fair briskness in the shipbuilding trade, as the total volume of goods carried is still as high as ever it has been with a steady and substantial increase. The Fairfield Co. have, we understand, something like 15,000 tons on hand, while Messrs. J. & G. Thomson are hard at work upon the notable Inman liners and the Spanish cruiser *Rena Regenta.* Messrs. Inglis also have no reason to grumble as to their present work in hand, and many builders are inclined to believe that we are on the eve of an improved state of things, and are laying in orders of large quantities of material on the prospect, in which we trust they will prove to be correct.

THE launch of the *Trafalgar* has marked, we think, an era in the construction of ironclads for the British Navy. For many years past a keen competition has been going on between England and various continental countries in the construction of more and more powerfully armoured battle ships. The *Trafalgar* will represent the heaviest and most powerful of all our armoured battle ships, having 12,000 tons displacement and four 67-ton guns. Her cost, too, by the time she is fully fitted and with stores on board, will represent not less than a million, which represents an enormous mass of money afloat at the mercy of a well directed and successfully planted torpedo. We fear that in the first naval engagement between the enormous and costly ironclad navies of the world there will be an immense sum of money sunk to the bottom of the ocean as the result of such conflict. If such heavy cost should in any way prove a deterrent to the horrors of warfare, it may do some good, but otherwise it rather resembles the well-known adage of "having too many eggs in one basket." The late review has, we think, impressed forcibly, not only on the minds of the authorities but also on the public at large, that the concentration of our resources in the comparatively small number of heavy floating batteries, such as our line of battle ironclads, leaves our extended seaboard, our enormous commercial marine, and our undefended towns extremely accessible for damage by an active and lightly armed foe. It is probable, therefore, that for the future there will be some revulsion in the design of future additions to the Navy, which will take the form of more lightly armed and swift vessels to act as scouts, patrols, or escorts. It is an open question whether it may not shortly be seriously contemplated to abandon armour and to substitute therefor enormous speed and great offensive and defensive power in the shape of torpedoes. The *Trafalgar* and the *Nile* are built on the type of the *Dreadnought,* planned by Sir Edward Reed, and although this type is considered by many obsolete long ago, it is of importance to remember that the *Dreadnought* has succeeded in winning what no other ship before or since her time has done, the general approval of naval officers. The construction of the *Trafalgar* from an old design is credited to the action of Lord George Hamilton and Admiral Hood, the senior Sea Lord, who, finding so much discrepancy of view among the naval architects as to the war ships of the future, thought it best to adopt a reproduction of that type to which they had found there was least objection on the part of those who sailed in them and would have to fight in them. The vitals of the ship, including the steering gear and the machinery which occupies it, are completely protected by armour plates from end to end, but the extremities of the vessel are left unarmoured, as it is contended that should either of the unprotected ends be entirely filled with water, the additional draught would not amount to more than $3\frac{1}{2}$ inches, and would not materially interfere with the speed, the stability, or the manœuvring power of the ship. The unusual situation of the magazine and shell rooms in the *Trafalgar* is a daring novelty. They are disposed at the middle line of the ship at each side of the engine and boiler rooms between the fore and aft bulkheads. This position is less exposed to the risk of hostile fire than when near the sides or the extremities, and the position is evidently most convenient for easy transport of ammunition to the guns. Hydraulic power is to be excessively employed on board the *Trafalgar,* in fact more so than in any other vessel at present in the service. The hydraulic system will be distributed throughout the vessel, dispensing with many duplicate steam engines and ensuring that the operations are carried on in a noiseless manner. This would seem to be an exceedingly convenient arrangement so long as it remains good and uninjured, but should anything happen to the hydraulic forcing machines it will paralyze not only the working of the heavy guns but also the steering gear and other movements usually driven by independent engines. There is little doubt that the *Trafalgar* is a vessel that may cheerfully engage with any of the heaviest ironclads afloat, even including those monsters, the *Italia* and the *Lepanto*; but for our part we think now that the general safety of the kingdom and its

enormous commercial marine would be best insured by a large access to the Navy of swift unarmoured cruisers.

The River Tyne, though of short length as regards its navigable distance, is one of the most important in England as regards its trade and traffic. Some most interesting details of the improvements that have lately been effected there during the last thirty years were given by Philip J. Messent, Esq., Engineer to the Tyne Commissioners, in a paper read before the Institution of Naval Architects last July. The piers or break-waters for the protection of vessels from the prevalent and destructive gales from north-east to south-east were commenced in 1856, to the design of the late Mr. Walker. They have absorbed upwards of 2,800,000 tons of stone, exclusive of lime and cement, their construction having been frequently interrupted by storms and heavy seas. In order to extend the masonry superstructure of the piers without staging, Mr. Messent designed and constructed a mammoth crane on each pier, which are capable of setting blocks of 40 tons weight at a distance of 92 ft. from the centre pivot. These are, we believe, the largest travelling cranes ever constructed for such a purpose. The bar having also been dredged by the Tyne Commissioners, the harbour has been largely used as a harbour of refuge by passing vessels. Above the outer bar referred to, which has now 20 ft. of water over it at low water, there was an inner bar, and stones, and a contracted channel above, called the narrows, which much impeded navigation. The 20 ft. channel has been carried over both bars and the obstructive narrows widened to 670 ft. In Shields harbour two dangerous shoals have been removed, giving an average depth of 30 ft. at low spring tides, something like 80 million tons of material having been dredged away since 1860. The old stone bridge at Newcastle has been removed and a handsome swing bridge, permitting river traffic, has been substituted for it. Several dangerous and obstructive points and cliffs are being removed to widen the river and straighten its course. Several docks and timber basins have been constructed by the Commissioners, and the works generally carried out by them have greatly added to the traffic in the river, and to the shipbuilding and engineering trades that have so rapidly developed upon its banks.

Until recently there has only been a 3-ton steam crane and some hand cranes at Aberdeen harbour, but a steam travelling crane capable of lifting five tons and stand the strain resulting from stopping this load instantaneously when falling, and to move on rails at four miles per hour, has been now delivered to the Harbour Board by Messrs. Blaikie Bros.

LAUNCH OF THE "TRAFALGAR."

On September 20th the double-turret ship *Trafalgar*, the largest and the most powerful ship in the British Navy, was launched at Portsmouth by Lady Hood, wife of the Senior Naval Lord of the Admiralty, under the happiest auspices. Fortunate in her design and in the comparative absence of unfavourable criticism regarding it, and fortunate in the cost and rapidity with which she was constructed, she was no less fortunate in the manner of her launching. The weather was all that could have been desired, and a prettier launch was never witnessed. There was not a hitch from beginning to end, and punctually at the appointed time, without the least hesitation, and without requiring the slightest persuasion from the hydraulic rams, she glided into the water on the simultaneous fall of the dogshores, amid the strains of "Rule Britannia" from the band of the Royal Marines and enthusiastic cheers, several times repeated, of thousands of spectators. The total weight of hull, when completed, is estimated to amount to 8,520 tons, and although at present she is destitute of her heavy citadel side armour and her turrets, the ship was understood to weigh in her launching trim about 5,400 tons. The enormous weight of the gigantic armourclad naturally caused the Constructive Department of the yard considerable anxiety, but every means were taken to achieve as well as deserve success. The hull rested upon 63 holding blocks set on a gradient of seven-eighths of an inch to a foot, the ship being on a slope of five-eighths, and a new system was adopted by Mr. Mitchell, the foreman in charge, by which the bilgeways were thoroughly lubricated without having to remove the sole and dagger planks, poppets, and store up. The lubrication was unusually thick, the foundation of tallow being five-eighths of an inch, over which there were layers of soft soap and train oil. A powerful hydraulic press, capable of exerting a pressure of 15,000 tons, was placed in contact with the stem, while two hydraulic rams of 4,500 tons pressure were placed on each bow in connection with the poppets. But, as has been already stated, these auxiliary aids to the force of gravity were not called into requisition. On the morning of the 19th and 20th ult., 16 gangs of workmen were employed at slack tide to drive in the slices, long and shallow wedges, which are used to lift the ship bodily so as to enable the sustaining blocks to be knocked out at the proper time; and so effectually had the work been performed that the ship was ascertained to be lively with 20 blocks below her. The ship herself was so bulky and the space on either side of the building shed so confined—in fact, her sides almost touched the standards while her ugly spur protruded over the road—that the accommodation at the disposal of spectators was necessarily limited.

At the head of the ship a booth was erected for the accommodation of distinguished officers and visitors, and those immediately concerned in the work and ceremony of launching, among whom were Lord George Hamilton, First Lord of the Admiralty, Admiral, Lady, and the Misses Hood, Admiral Hoskins, Admiral Graham, Mr. Ashmead-Bartlett, and Mr. Forwood, Admiral Sir George Willes (Commander-in-Chief) and Lady Willes, Admiral Hopkins (Superintendent of the Yard), Admiral Sir Henry Keppel, Admiral Jones, General Sir George Willis, General and Lady Fitzwygram, Lord and Lady Robert Bruce, Admiral Sir George Elliot, Mr. White (Director of Naval Construction), Mr. Elgar (Director of Dockyards), Mr. Stainer, Mr. Deadman (Chief Constructor), Mr. Fitze (Assistant Constructor), the Mayor of Portsmouth (Sir W. D. King), and others. Stages were also erected at the bows for the accommodation of naval and military officers in uniform and their friends, while the general public took possession of the building galleries and flats, and wherever they could obtain a glimpse of the ship. The whole of the booths were ornamented with a display of bunting, and underneath the band of the Royal Marine Light Infantry played a lively selection of music while the work of freeing the vessel was being performed. The *Trafalgar* herself was made to exhibit a significant assortment of flags, including the Royal Standard, the Admiralty flag, the Union Jack, and the white ensign. The *modus operandi* of the launch was arranged to give as little trouble as possible: The inevitable bottle of wine, disguised by a profusion of flowers, was suspended from a clutch at the head of the vessel and weighted so as to cause it to fall true to the mark. All that was required was for Lady Hood to cut the string when the clutch released its hold and the bottle was dashed against the ram. The manner of releasing the dogshores was equally simple and ingenious, the application of electricity being wholly dispensed with. An endless rope was led through groves from the platform along the bows until the weights to which it was attached (each half a ton) were poised about 13 ft

above the dogshores. When, therefore, Lady Hood severed the rope with a mallet and chisel the weights would fall upon the shores with a momentum estimated at 50 tons and the ship be released from its last remaining hold. At half-past 12 the Rev. Cox Edwards, the chaplain of the Dockyard, performed the customary religious service. The tide at this moment had risen to 12ft. 6in., and all but 17 blocks out of the 63 had been removed and the ship was beginning to draw. From this time onward block after block was removed by means of battering rams with comparative ease, showing the efficient way in which the setting up had been accomplished. At 12.50 the tide at the stern had risen to 12ft. 11in., and all the blocks but 12 had been removed from under. As the ship was showing signs of wanting to be off and no time was to be lost, Mr. Deadman considered it unnecessary to distress her further. The men were accordingly ordered from under the bilges, and Lady Hood, cutting the riband which upheld the bottle, the wine was spattered upon the stem, and she named the ship "The Trafalgar." After the cheering, which was raised on the initiative of Admiral Hopkins, had subsided, Lady Hood next severed the rope before-mentioned, whereupon the dogshores so completely succumbed under the impact of the heavy weights that, without its being necessary to use either hammer or rams, the vessel rushed with ever-increasing momentum down the slippery ground-ways into the harbour, where she was easily and quickly brought up by means of an "Improved Martin's" anchor. This new pattern anchor has been most successful, and its merits have been recognized, not only by our own, but by many Foreign Governments, who are fitting them extensively to their new vessels. From the reading of the service to the ship taking the water at five minutes to one only 25 minutes elapsed.

The *Trafalgar* is 345 ft. long between the perpendiculars, and 73 ft. broad. Her load draught of water will be 27 ft. forward and 28 ft. aft when fully equipped for sea, and her displacement tonnage is 12,000. Her coal stowage is 900 tons, which is carried in fore and aft bunkers, extending from the fore end of her double bottom to the after end of the engine room. Her armament is to consist of four 13½ in. 67-ton breach-loading guns, eight 5 in. breach-loading guns, or six 36-pounder quick-firing guns; eight 6-pounder and 11 3-pounder Hotchkiss quick-firing guns; machine, boat, and field guns, and 24 Whitehead torpedoes. The turret guns fire a projectile weighing 1,250 lb., with a powder charge of 630 lb., and train through an angle of 270 deg. The eight 5 in. guns will be mounted on the upper deck between the turrets, and will be protected on the sides of the ship from rifle fire by two thicknesses of ½ in. plating, and at each end of the battery by an armour bulkhead 5 in. thick, fitted upon 6 in. of backing and an inner skin. These guns will train through 90 deg. on each side of the beam. The eight 6-pounder Hotchkiss guns will all be fought from the spar deck, but the 3-pounder guns will be distributed between the spar deck, bridge, stern, ports, and military tops. There are eight torpedo tubes, four above and four below water. The latter are fixed tubes. Of the above-water tubes, which are on the main deck, one at the bow and one at the stern are fixed; the others, one on each side at fore end of citadel, are trained to fire 70 deg. before and 10 deg. abaft the beam. The whole of the above-water tubes are protected from machine gun fire by 2 in. plating. The vessel is fitted with twin screws, each to be driven by an independent set of triple expansion engines by Messrs. Humphrys, Tennant & Co., with three vertical cylinders of the collective power of 6,000 horses for each set. Each set of engines has cylinders of 43 in., 62 in., and 96 in., with a stroke of 4 ft. 3 in. The weight of this machinery is 1,030 tons. The crank and propeller shafting are hollow, and made of compressed steel. The diameter of the screw propellers will be about 16 ft. The boilers are six in number and of cylindrical form, the shells being of Siemens-Martin's steel and the furnaces corrugated. Fans driven by steam power are fitted for supplying forced draught to the boiler rooms, and the vessel, when under forced draught, is expected to attain a full power of 12,000 indicated horses, which must be maintained at the official trial of the machinery for four consecutive hours. With this power a speed of 16½ knots is anticipated. The steaming distance of the ship under full power is 1,050 knots, and at 10-knots speed 5,500 knots. With the stokeholes not under forced draught the anticipated power of engines is 7,500 horses, which must be maintained at the official trial for four consecutive hours. Her structural details are in some respects unique, particularly in the construction of her armoured side and turrets. The construction of side behind the thick armour consists of two thicknesses of skin, the outer of 60 lb. and the inner of 30 lb. per square foot, riveted to plate and angle frames 2 ft. deep and 2 ft. apart. On the inside of these frames plating of 20 lb. per square foot is worked, and the belt and citadel armour bolts are hove up between them on the inner end of a cast steel sleeve about 12 in. long. Within these frames and behind the belt armour only in a second system of lightened plate frames, 3 ft. deep and 4 ft. apart, on the inside of which the outer bulkhead of the coal bunkers is riveted. The strength of the armoured side is thus exceptionally great. The engine and boiler rooms are divided at the middle line of the ship by a watertight tunnel 10ft. 6in. wide. The upper part of the tunnel forms a passage for communication between the ends of the ship, and also for the passage of ammunition through the deck above for the auxiliary armament; the lower part forms the main magazine and shell room of the ship. She has a ram bow. Her stem, which is of cast steel, is strengthened in wake of the projecting portion under water by a horizontal prow consisting of two 5 in. armour plates. She has an armoured belt 230 ft. long, surmounted by an armoured citadel 141 ft. long at the sides of the ship, these structures being bounded by armoured bulkheads, those of the citadel being curved. The length from end to end of the citadel is 193 ft. At the end of the citadel and within the limits of the armoured belt the turrets are placed, the extension of the belt at each end beyond the ends of the citadel forming a protection to the substructure and machinery of the turrets.

The whole of the armour on belt, citadel, turrets, and conning tower is steel faced. The side armour varies in thickness on the belt from 20 in. to 14 in., tapering at the lower edge from 8 in. to 6 in. The boundary bulkheads to belt are armoured with 16 in. and 14 in. plates, tapering at the lower part to 7 in. The citadel armour varies from 18 in. to 16 in. Above the citadel armour screens are fitted 5 in. thick, protecting the 5 in. guns from raking fire. The turret framing is constructed similarly to the armoured side of the ship, the armour being 18 in. thick. The total thickness of wall is 4 ft. for armoured citadel, belt, and turrets, and 5 ft. for the armoured ends of belt.

She is well subdivided by watertight compartments, as follows:—In the double bottom 40, below the protective deck and before the double bottom 13, abaft it 18, and in hold in wake of the double bottom 49, including eight divisions in the coal bunkers, or a total of 120 watertight compartments below the protective deck. On this deck before and abaft the armoured citadel there are 14 such compartments. These are in wake of the waterline, and being filled with stores would give considerable buoyancy to the relatively very small unarmoured ends of the ship when riddled. The ship will be controlled in action from a pilot tower, protected by 14 inches of armour, which stands upon the spar deck, and will be fitted with steering wheels and telegraph, voice pipes to the various steering wheels, engine-rooms, guns, and torpedo-tubes, and also with gun and torpedo directors, which will enable the officer in the tower to direct the training of the turret guns, and also of the 5 in. guns, on any object, and to fire them simultaneously.

In addition to this tower there will be two side conning towers protected from machine-gun fire; and from these positions also the ship may be steered, and the turret guns fired. The upper deck over the citadel is plated with two thicknesses of steel plating, each weighing 60lb. per square foot, while the main deck between the ends of the armoured belt and ends of citadel is covered with plating of the same thickness. This protective plating is continued to the extremities of the ship on the lower deck beyond the limits of the armoured belt. She will be fitted to steer both by hand and steam, the steam steering engine being a double cylinder direct-acting one, and of sufficient power to put the helm from hard-a-port to hard-a-starboard, and *vice-versa*, or through an angle of 70 deg. in 30 seconds when the vessel is proceeding at full speed. The steam-steering gear can be controlled either from the armoured pilot tower, the chart-house on the bridge, the side conning towers, or, in the event of the pilot tower gear being disabled, from a protected position on the platform deck directly below the tower. The hand-steering wheel is fitted under the protective deck and close to the steering engines. Electricity will play an important part in the ship's economy, as she will be lighted throughout with over 460 incandescent lamps, and will be fitted with four search lights in side towers, two on the spar deck and two on the main deck. The turret guns and auxiliary armament of 5 in. breech-loading or 36-pounder quick-firing guns, will also be electrically discharged. For these purposes she will have three powerful dynamos of 400 ampères each. The arrangements for freeing the vessel from water are very complete. This may be done either by hand or steam power, Downton's pumps being used for hand, and the circulating pumps in engine-room, as well as the bilge pump donkey-engines, for steam power. In each engine-

room two main circulating pumps and two engines will be fitted, each large enough for full power working, and these can be used also for pumping out the bilges of the ship in the event of a leak. Each of these circulating pump engines will be powerful enough to discharge 1,000 tons of water from the bilge per hour. In each engine-room there will also be fitted a steam-pumping engine, adapted as a fire engine, and two similar auxiliary engines for pumping out the ship and boilers and washing decks, &c.

A complete system of ventilation is adoped for the ship, combining natural with artificial ventilation, the former being resorted to as far as possible; but the principal compartments at the extremities of the ship below the protective deck, and also the living spaces above it, are supplied with a forced current of air, and corresponding means of exhaust. The weight of the ship as launched is about 5,400 tons, and including the weight of the bilgeways, poppets, and other gear for launching her, the total weight upon the groundways is over 5,700 tons. The pressure per square foot upon the groundways is about 2·9 tons. The ship has been pushed rapidly forward from her commencement on the 18th of January, 1886, when the first keel plate was laid, the average weight worked into her per day from that time being ten tons. This rapidity in construction has been accompanied by a considerable reduction in the cost of building as compared with that of the other large armourclads previously built at this yard, as the following statement will show: On the 3rd of September, 1887, 5,171 tons had been worked into the hull of the ship, exclusive of machinery, &c. This weight has been, therefore, taken for comparison with other ships named :—

Name.	Tons weight worked into hull.	Cost.	Number of weeks after commencement.	Average weight per week.	Average cost of labour.
		£		Tons.	£
Trafalgar ..	5,171	73,633	85	60·8	14·4
Camperdown	5,171	115,005	146	35·4	22·4
Colossus ..	5,171	171,983	183½	28·1	33·5

The launching weight of some previous ships are also given, with the cost of labour up to this stage.

Ships.	Weight of hull as launched.	Cost of labour.	Price per ton for labour on hull as launched.
	Tons.	£	£
Inflexible	3,482	76,500	21·97
Colossus	3,953	135,741	34·3
Camperdown	4,330	97,001	22·4
Trafalgar	5,220	76,080	14·56

The work has been carried out under the immediate direction of Mr. H. E. Deadman, R.C.N.C., Chief Constructor; Mr. W. J. Fitze, R.C.N.C., Constructor; and Mr. T. Mitchell, Foreman of the Yard.

THE MANCHESTER ROYAL JUBILEE EXHIBITION.

DECIDEDLY the most successful exhibition of this Jubilee year is that of Manchester, whether it be in the extensive and varied character of the exhibits, or their systematic grouping and arrangement. This success, we believe, is largely due to the fact that the Executive and Sectional Committees have taken not only an active interest in the numerous details, consequent on the massing the exhibits in an orderly and accessible manner, but because the various committees have actually superintended the work. As might be anticipated in Manchester, the centre of the cotton and allied industries, textile machinery bulks largely, but at the same time there are many objects interesting to marine engineers and shipbuilders. Most of these it will be our privilege to refer to, and, as far as possible, illustrate and describe. We are pleased to see that a section has been allotted to the industries of Ireland. There is also one of the largest and most varied collections of fine art exhibits that has ever been shown in one building. The old Manchester and Salford erections, with their "old world" inhabitants, are no unimportant feature, nor are the large botanical collections. Naturally, however, our attention was principally attracted by the following sections:—Handicrafts; Chemical and Collateral Industries; Machinery; and Industrial Design. Although the Handicrafts Section contains many exhibits of general interest, there was nothing specially attractive to our readers, with possibly a few exceptions.

Mr. A. G. Thornton, of 109, Deansgate, Manchester, had the only stand devoted to instruments and other requisites for draughtsmen, and the stand of the City Wood Engraving Company, Arcade Chambers, St. Mary's Gate, Manchester, was of some interest, as there we saw men in actual work upon engravings, besides specimens of drawing on wood, electrotyping, &c.

The Irish Section.

In entering the Irish section our attention was at first attracted by the exhibits of Messrs. W. Curtis & Sons, 98 and 99, Abbey Street, Dublin. Their stand is exceedingly effective in its arrangements, and illustrative of the brass-finishing, coppersmith, nickel plating, and engraving work this firm is actively engaged in. Several of their exhibits were of articles used in brewing, but we also noticed well-finished Board of Trade signal lamps for ships, a signal gun of brass highly polished, hose couplings and conductors, and a fine assortment of sight-feed lubricators, suitable for marine engines, &c., a speciality this firm has been making for many years. This stand is surrounded by a heavy brass rail and stanchions, and altogether attractively arranged.

Messrs. J. Edmundson & Co., Limited, 33 to 36, Capel Street, Dublin, and 19, Great George Street, Westminster, have their exhibits in the same neighbourhood. They are among the most striking in the Irish section, and cannot fail to attract attention. To those whose lives are mostly spent on the "ocean waves," they are specially interesting, as they are all illustrative of lighthouse lighting. We regret that pressure on our space precludes a full description of this company's exhibits, but we may briefly state that while showing models of lighthouse lanterns, such as Tuskar, Galley Head, Mew Island, &c., the most important exhibit is Wigham's Patent Double Quadriform Gas Light, having an illuminating surface of about 16 ft. by 8 ft. The latter gives some idea of the gigantic nature of lighthouse lighting arrangements.

Messrs. Thomas Grendon & Co., Drogheda Iron Works, Drogheda, besides exhibiting castings of locomotive cylinders, &c., have at their stand three models of vessels they have built, viz., the sailing vessel *Saint*, of 107 tons gross register, the yacht *Puck*, and a 1,000 ton barge.

Messrs. Bewley, Webb & Co., of the Port of Dublin Shipyard, Northwall, Dublin, have likewise specimens of their naval architectural skill on view, besides machinery; but the latter is not of a nature interesting to our readers. The vessels represented by their models are the paddle steamer *Countess of Erne*, 240 ft. in length, 29 ft. beam, 14 ft. 6 in. depth, 996 tons O.M.; and the paddle steamer *Anna Liffey*, 190 ft. in length, 20 ft. beam, 11 ft. 4 in. depth moulded. The latter vessel is double ended, having two of Laird's patent rudders, was built for the Dublin and Kingstown Steam Packet Company, and attains a speed of 10 knots.

Mr. Matthew Byrne, of 42, James Street, Dublin, shows specimens of his bell-founding. Two of the bells exhibited appear to be highly suitable for placing on the end of the forecastle deck, for use at sea; while the larger exhibit weighs no less than 22 cwt. and 4 ft. in diameter.

Mr. John Murphy, of 14, Thomas Street, Dublin, exhibits a bell of even larger dimensions, weighing 27¾ cwt., as well as a gland cock, sluice valve, &c.

Mr. James Dillon, C.E., M.I.C.E., Stratford, Glengeary, Co. Dublin, exhibits diagrams and model of his patent automatic sounding machine and tide recorder. This sounding apparatus has been in use for more than five years, and has lately been much improved. It consists of a sounding bar or tube, or weighted sounding wire, working dial hands or pencil pointers on rolls of section paper, recording automatically the varying depth of water; and is of special use for ascertaining the amount of dredging or river excavation during the progress of harbour and dock works. As the wave motion does not prevent the instrument working accurately, it can also be used on board mercantile or war ships to indicate by semaphore signals or diagrams, on rolls of paper, the rise or fall of ground under the vessel's bottom, specially advantageous when navigating dangerous waters, or approaching a coast-line in a dense fog. This is effected by the varying angle of the sounding tube resting on the ground. This invention is also applicable to other uses, such as recording and telegraphing to a distant town the rate of consumption, or the rise and fall of reservoir waters for the supply of towns.

William A. Traill, C.E., Giant's Causeway Electric Tramway, Portrush, Co. Antrim, has forwarded for exhibition a model of an overhead electric railway for the Mersey Docks, at Liverpool, with a working model electric car. For many years there has been an expectancy of something in the shape of an overhead railway being constructed at the Liverpool Docks; possibly Mr. Traill's suggested adoption of an electric railway may lead to the carrying out of this much needed accommodation.

Messrs. Daniel Miller & Co., of 29, Church Street, Dublin, is another firm which has a large display of copper and brasswork, and the specimens of copper boilers, cylinders, &c., exhibited, show that this firm is equal to executing the largest class of work.

The Belfast Ropework Company, Limited, Connswater, Belfast, have a very fine show of their manufactures arranged in pyramidal fashion, which includes ropes for transmitting power, hoists, block ropes, and ordinary ships' running gear, and a close examination shows that this company's manufactures are of a high-class character.

Messrs. J. & L. F. Goodbody, of Clare, King's County, Ireland, have also among their varied exhibits articles used on board ship, such as tarpaulins, ropes, &c.

The Chemical and Collateral Industries Section.

Crossing to the Chemical and Collateral Industries department, which is sub-divided into fifteen groups, the first exhibitors in the twelfth group, which is devoted to india rubber, gutta-percha, &c., is that of Messrs. David Moseley & Sons, the well-known india rubber manufacturers, Chapel Field Works, Ardwick, Manchester. The stand of this firm is the very largest and most effective in its appearance in its department, and being accessible on its front and both sides, admits of a ready inspection. Each side of it is flanked with handsome glass cases, about 12 ft. high, filled with the most elegant samples of india rubber manufacture in the shape of ladies' and gentlemen's patent Coruscus waterproof garments, and other articles of a varied character. From the front of the stand, which faces a cross passage, extending across the court assigned to Section III., the visitor sees an immense and costly collection of india rubber products, including railway buffers, horse-shoe pads, rings of every description and size. In the background are large quantities of india rubber lined hose, ordinary india rubber hose piping of all sizes, including those suitable for scalding hose in the stokehold, &c. The valves and washers of almost every possible size, suitable for marine engineering and similar purposes, on close inspection, we could not but pronounce as perfect; and it is easy to see how Messrs. David Moseley & Sons have deservedly a world-wide renown for their manufactures. Anchor linen fire hose, patent brass hose couplings, conductors, stop-cocks of all usual sizes for fire extinction purposes, on land and on board ship, are to be seen over the office on the right hand side, and to the left are various kinds of india rubber articles used for railway purposes. In the centre of the stand the large quantities of the patent "Simplex" machine belting, one of the most approved specialities of Messrs. David Moseley & Sons, riveted our attention. Experience has shown that the "Simplex" belting is one of, if not the most efficient, lasting, and economical belting for use in any marine or land engineering shop. It is made in any required width, and we know that as narrow as nine inches and as wide as 24 inches, it has given every satisfaction. Many machine manufacturers supply it solely to machinery going abroad, as it is unaffected by climate. Those of our readers, and they are many, who are interested in having reliable, uniformly steady working belts, should, if they have not yet given the patent "Simplex" machine belting a trial, do so at once. It is to be seen daily at work in the Exhibition, as it is used for the main driving of the machinery. There is also in the centre of the stand india rubber sheeting in numerous and immense rolls, raw india rubber, and the same product in various stages of manufacture also meets the visitor's vision. On the left hand in the foreground an object of general notice is that of a complete costume for a diver, expanded with air, equipped with helmet, boots, &c., complete, which we believe has been mistaken at first sight for an actual diver. Large quantities of garden hose piping, india rubber packing in vast variety, are also on view.

Attention has already been called to the large vertical glass cases, and the principal articles exhibited in them, by Messrs. David Moseley & Sons, but in addition there are projecting horizontal glass cases, the contents of which should not escape the attention of the intelligent visitor. Here we see india rubber applied to the manufacture of surgical and chemical instruments, and if never before, now realise the vast, varied, and important uses to which this natural product can be applied. While it is almost impossible to over-rate the value of india rubber, at the same time, it cannot be forgotten that for its successful application to the many and varied purposes for which it is now indispensable, a debt of gratitude is owing to such firms as Messrs. David Moseley & Sons, Manchester, who spare no pains in developing and improving its manufacture. That firm may well feel proud of their exhibits to which we have now, all too briefly and inadequately alluded, more especially as in no respect are they a mere show got up for the occasion, but as in each instance their exhibits are an ordinary sample of the undoubtedly first-class materials and articles they daily supply their numerous customers at home and abroad.

Never do we remember seeing such a large number of large stands devoted to exhibits of india rubber manufactures.

Messrs. J. Mandleberg & Co., of the Albion Rubber Works, Pendleton, Manchester, have an extensive and commendable display, more especially of articles most attractive to general visitors.

Messrs. Broadhurst & Co., Bradford, Manchester, have a large stand devoted to various specimens of manufactures in india rubber, including spiral coils of piston packing with india rubber cores, and various kinds of india rubber and cotton packing for pistons, glands, &c., as well as samples of raw, washed, and manufactured india rubber.

Messrs. William Currie & Co., of the Caledonian Rubber Works, Edinburgh, is another firm which has a specially attractive display in this department.

Messrs. Charles Macintosh & Co., of Cambridge Street, Manchester, amongst their exhibits illustrative of the manufacturing processes and products of india rubber, have on view an inflated india rubber boat, equipped with a pair of oars, which will accommodate two persons; besides pump valves, life-saving mattrasses, &c.

Mr. Isidor Frankenburg, of the Greengate Rubber and Leather Works, Salford, Manchester, has also a very large and varied collection of india rubber and leather goods on view, as well as specimens of unmanufactured india rubber.

The Ancoats Vale Rubber Company, Limited, Palmerston Street, Ancoats, Manchester, who are contractors to the Admiralty, have one of the largest and most attractive stands in their special department. Specialities exhibited by this company are oil-resisting air pump valves for marine and land engines, and a patent corrugated non-slipping india rubber belting.

Continuing our inspection of the section devoted to Chemical and Collateral Industries, at the stand of

Messrs. W. H. Bailey & Co., of the Albion Works, Salford, Manchester, we saw amongst their numerous specialities their patent pyrometers for marine boilers, Thurston's patent oil testers, Ingram & Stapfer's oil tester, illustrations of Bailey's patent tide recorder, and specimens of Bailey's absolute vacuum gauge, which shows the vacuum pressure in condensers, and its relation to barometrical pressure of the atmosphere. This firm's exhibits, are, however, of a far greater variety than we have indicated, as we are only noticing such as are likely to be useful to marine engineers.

The Harden Star and Sinclair Fire Appliance Company, Limited, Cathedral Steps, Victoria Street, Manchester, have a large stand, and besides exhibiting a splendid assortment of fire extinguishing appliances, including their well-known specialities, also exhibit apparatus for the "Lucigen" light, as well as the electrogen for preventing incrustation and corrosion in steam boilers, and Hannay's deep sea sounding apparatus, "Bathymeter," which have already been described in our columns.

Mr. Joseph Casartelli, 43, Market Street, Manchester; works, Clarence Street, Cheetham, Manchester, is to the front with a large and varied assortment of appliances, arranged systematically in a very beautiful show-case. Amongst a variety of indicators, we saw the Admiralty pattern, both for steam and gas engines, and for high speed engines; Casartelli's engine counter, mercurial vacuum gauge, pyrometers, &c. The specialities of this well-known instrument maker, and their very high-class finish, are too well known to require a lengthened notice; but it may be pointed out that he has paid special attention to perfecting indicator springs for the high pressures of steam now in vogue.

In the third and tenth group of the Chemical and Collateral Industries, we noticed a number of exhibitors of lubricating materials. Foremost among the number is the firm of Messrs. A. B. Fleming & Company, Limited, Caroline Park, Edinburgh. This well-known firm of oil distillers, refiners, and merchants, have a large stand consisting of a handsome, hardwood framed

inlaid with brass, plate glass show case, in which they exhibit specimens of several of their specialities.

We would call our readers special attention to their patent solidified oil, for lubricating tunnel and crank-shaft bearings, and for use wherever tallow and suet is applicable as lubricants. It is increasingly being employed in steamships, as might be expected from its characteristics, some of the principal of which are: that its melting point is that of boiling water, viz., 212° Fahrt.; that though solid it is soft, and is not affected injuriously by cold; that it leaves no deposit in cylinders; protects india rubber valves, boiler plates, and tubes from corrosion, and when passed into the feed-water with the exhaust steam, prevents incrustation in the boilers. Owing to its durable properties, it is more economical than suet, tallow, or ordinary oil lubricants, never running or splashing.

This patent solidified oil is supplied in three qualities: for ordinary work, for marine engine shafting, and for cylinders. On analysis it has been found to be compounded of oleaginous materials, free from animal and vegetable fatty acids, nor does it when subjected to a high degree of heat, liberate free acids. Both in laboratory experiments and actual practice it has displayed no gumming and clogging tendencies, and it is thus cleaner than many ordinary lubricants.

Pressure on our space prevents reference to the remaining exhibits of these enterprising manufacturers, A. B. Fleming and Company, Limited.

The Linlithgow Oil Company, Limited, Edinburgh, 4, St. Ann's Square, Manchester, &c., have a well-arranged case of exhibits, including specimens of shale, crude mineral or shale oil, burning oil, heavy or lubricating oil, naphtha, &c.

Price's Patent Candle Company, Limited, Belmont Works, Battersea, London, S.W., exhibit specimens of their well-known specialities, including lubricating oils, paraffin, &c.; and a bust of her Majesty the Queen, in stearic acid, is an artistic attraction in their case of exhibits.

The Broxburn Oil Company, Limited, 28, Royal Exchange Square, Glasgow, and the Dee Oil Company of Manchester, London, Liverpool, Newcastle-on-Tyne, and Barrow-in-Furness, are also exhibitors of lubricating oils of various specific gravities.

Messrs. William Taylor & Co., Limited, Taylor's Wharf, Limehouse, London, and Messrs. Walter R. Taylor & Co., of Whitechapel, Liverpool, have one of the most effective and imposing stands in the group assigned to paints and varnishes. Amongst the numerous exhibits of this firm we can only briefly refer to a few. Their anti-fouling and anti-corrosive compositions for ships' bottoms specially attracted our attention, as it appears to have proved highly successful whenever used. A great advantage possessed by this paint is that there is the *minimum* of delay to a vessel having the bottom painted with it, as three coats can be satisfactorily applied in one day. Specimens of the paint; both in small and large quantities, are shown, as well as several models of ships and steamers coated with their patent compositions. We understand this firm has obtained three medals, including a gold medal at last year's Liverpool Exhibition for their specialities.

In the metallurgy group, the exhibits of Mr. Percy C. Gilchrist, 101, Palace Chambers, Bridge Street, Westminster, S.W., cannot be overlooked. In our last number we called special attention to the success which is now attending the working of the Thomas Gilchrist process; and a brief reference to the exhibits of the surviving inventor of this process must now suffice. These exhibits include a boiler front, flange, &c., ready for use, manufactured of Basic-Bessemer or Thomas-Gilchrist steel, by Messrs. Merry & Cunningham of Glasgow, and a large number of specimens of the same material, including flanged and dished plates, twisted cold bars, &c., manufactured by the Glasgow Iron Company, Limited, showing that it is possible to manufacture Basic-Bessemer steel of the very highest quality, equal to that obtained by the Siemens-Martin process.

The West Cumberland Iron and Steel Company, Limited, of Workington, Cumberland, have a large and varied collection of materials used and products obtained in the manufacture of iron and steel. A collapsed furnace illustrates the great yielding qualities of steel, and shows what a safeguard the use of reliable steel in boiler construction is against explosions. Steel plates which have been subjected to dynamite explosion, numerous test pieces, &c., are included in the exhibits of this company, as well as a sample of the first Basic steel which was manufactured in 1872 by Mr. George Snelus.

Webster's Patent Aluminium Crown Metal Company, of 34, St. Mary Axe, London, E.C., have a splendid assortment of specimens of their metals and goods manufactured from them; and amongst the latter we noticed reflectors for lighthouses, for which their metal appears to be highly suitable. There appears to be a great future in store for aluminium, and as manufactured by the Webster's Patent Aluminium Crown Metal Company there is a certainty of obtaining a material of great tensile strength, which will neither rust nor tarnish.

MODERN IRON-WORKING MACHINERY IN SHIPBUILDING YARDS.

No. 1.—Machine Tools for Preparation of Plates, Bars, &c.

THE machines in use at the present day for preparing the separate and multitudinous pieces of material which go to form the hull structure of iron and steel vessels are both numerous and highly efficient. This work of preparing material, it may be shortly stated, mainly consists of shearing and planing the edges of plates and bars, these, as supplied by the manufacturer, being, of course, only approximately near the final form and dimensions—rolling and flattening, or giving uniform curvature to plates; bending angle or other bars, such as are used for deck beams, and punching the holes through plates and bars for the reception of rivets. This enumeration takes no account of the operations concerned with material in the heated state, the features requiring to be thus manipulated being principally the frames and reverse frames, and a certain proportion of the bottom plates of the vessel. For this purpose one or two machine tools have within recent years been brought into requisition, some notice of which will be taken presently. With reference to the proportion of material required to be heated before manipulation, it may here be noted that the employment of mild steel is a source of economy in this connection, as compared with iron. The superior homogenity, and great ductility of the material favours cold bending, when such an operation would be fatal to iron. Not only does an economy in labour result, but incidentally, there is a further advantage. Cold bending distresses steel less than hot bending, and the special precautions so often taken, in the way of annealing, to toughen steel which has been operated upon when hot, are thus obviated.

While most of the machines used for manipulating material in the cold state have been introduced for a period exceeding that with which our articles are more directly concerned, improved types have been made, and entirely new machines brought into requisition during recent times. The universal adoption of piece-work in almost all the departments of construction has demanded a more economical type of machine than formerly. In this way punching machines, which play so important a part in shipyards, have risen from a working speed of about fourteen rivet-holes per minute to thirty, and even in the case of frame punching to as high as forty per minute. Other machines have had a corresponding increase in speed, in several of the best appointed yards the general increase being about sixty per cent.

The introduction of the double bottom for water ballast in ships brought about a great increase in the amount of punching necessary, caused by the numerous manholes, air, and limber holes required through the floors and longitudinals. These manholes, oval in shape, and of various sizes, had to be punched all round by the rivet-punch, and the edges afterwards dressed by hand with a chisel. To economize work in this direction, need was felt for a machine which would be capable of punching a manhole of the ordinary size out of the thickest plate at one operation. In 1879, at the request of one of the prominent Clyde firms, Messrs. Craig and Donald, the well known machine-tool makers of Johnstone, introduced a manhole punching machine which cut holes 18 in. by 12 in. at the rate of seven per minute, in such a way that no after-dressing with chisels was required. This machine, an ordinary eccentric motion, driven by its own engine, although tested and found capable of cutting an 18 in. by 12 in. hole through a plate 1 in. thick, was superseded in the yard for which it was made, by another, designed to meet the requirements of the heaviest type of vessels built, on the cellular principle. This machine, also made by Messrs. Craig & Donald (illustrated on page 230), and five or six of which are now at work in yards on the Clyde and at Barrow, is capable of piercing a hole 30 in. by 21 in. through a plate ¾ in. thick at one operation, and is actuated by hydraulic power. The ordinary eccentric machine, driven by engine attached, is still in favour for lighter work, and machines of this type are at work in several of the East Coast yards, capable of punching holes up to 21 in. by 15 in. through plates ¾ in. thick.

The extended adoption of steel, and especially the increased dimensions of plates which the manufacturers of that material, aided by the new plant constructed for modern needs, have been enabled to offer to shipbuilders, free from the extra charges which the manufacturers of iron were in the habit of imposing, has brought about a development in shipbuilding plant. The advantages pertaining to the use of plates of increased dimensions are clear and considerable. By using in shipbuilding the large plates now possible by steel manufacture, less weight for a given thickness is used in laps and butt straps, less riveting is required, less scrap is produced, less time is required in construction, and less cost for labour is involved. In a paper on "Steel Shipbuilding," read before the Iron and Steel Institute at its Glasgow meeting in 1885, it was conclusively shown by the author—Mr. J. H. Biles—that by employing plates with the length of 2 ft. and the breadth of 6 in. greater than those ordinarily employed either in steel or iron, the reduction in total weight due to the increased dimensions alone would be 2·5 per cent. on a 1,500-ton sailing ship, and 1·37 per cent. on a 5,000-ton steamer. Mr. E. Windsor Richards, in the discussion on this paper, said he would be very glad to be informed what was the largest size of plates which could be conveniently dealt with in a shipyard. He saw no difficulty in producing steel plates, 50 ft. to 60 ft. long by 5 ft. wide, or even larger if required. Referring to this, Mr. Biles replied that he had used plates 5-16 in. and 3-8 in. thick up to 16 ft. long by 5 ft. broad. These plates were used in a small ship, and involved the maximum difficulty in curving. He considered that plates up to 24 ft. long by 7 ft. 6 in. wide could be conveniently employed on large ships if shipbuilders would alter their plant. For dock plating the only limit would be the depth of gap in the punching machines, and the power of the lifting appliances. In the yard with which he was connected—Messrs. J. and G. Thomson, Clydebank—they had punching machines with 30 in. depth of gap, so that they could punch all the holes in plates up to 6 ft. wide. For wider plates some holes in the centre would have to be drilled, but the extra cost of this would be more than compensated by the other savings resulting from the use of wider plates.

Throughout shipyards generally the standard working length for merchant ship plates until very recent times was 16 ft., many cases especially where iron is still largely used—14 ft. was the customary length adopted. Plates of greater length than 16 ft. were seldom used, except in cases where, in order to obtain a good shift of butts, or to save a butt near the termination of the strakes, 18 ft., or even longer, plates were employed. This length, however, was not possible to those plates amidships—bilge or otherwise—having considerable and uniform curvature, simply because of the limited size of the rolls with which shipyards, even the best appointed, were provided. A demand for shipyard plant of increased calibre was not, however, long in making itself felt. In the early part of 1886 the Barrow Shipbuilding Company were enabled to use, in the construction of the Pacific Steam Navigation Company's *Orizaba*, plates of 22 ft. and 24 ft. in length, the rolling plant of the builders being, of course, adequate to the increased length of plate thus introduced. Few, if any, shipbuilding firms at that time had rolls capable of receiving plates over 16 ft. or 18 ft. long. As regards punching machines, the maximum capability seems to have been attained in machines with 36 in. gap, capable of piercing plates of a width of 6 ft. During 1886 Messrs. Harland & Wolff, of Belfast, introduced a plate-bending machine, made by Messrs. Shanks, of Johnstone, capable of admitting a plate 28 ft. long, as well as planing and punching machines to correspond. Notable amongst these were two extra large punching machines, with gaps 42 in. deep, which permit of plates 7 ft. broad being punched in the centre, these being supplied by Messrs. J. Bennie & Co., Glasgow. On the Clyde, Messrs. Alex. Stephen & Sons took the lead in acquiring such enlarged plant. They contracted in the latter part of 1886, with Messrs. Bennie & Co., for a plate-bending machine 25 ft. in length, the largest of the kind in the shipyards of the Clyde. During 1886 and the present year the same firm of tool-makers supplied to Sir W. Armstrong, Mitchell & Co., Newcastle-on-Tyne, and other firms, punching and shearing machines of extra large calibre. One of the machines supplied to the firm named weighed no less than 54 tons, had its own engine, and was otherwise self-contained. It was designed to punch holes in steel plates 2 in. thick, having a gap 33 in. deep. In addition, it was capable of punching manholes up to 15 in. diameter, and to shear plates of 2 in. thickness. Amongst other machines acquired by this firm are two extra large punching machines, with 42 in. gap, made by Messrs. Bennie & Co., and similar to those previously supplied to Messrs. Harland & Wolff.

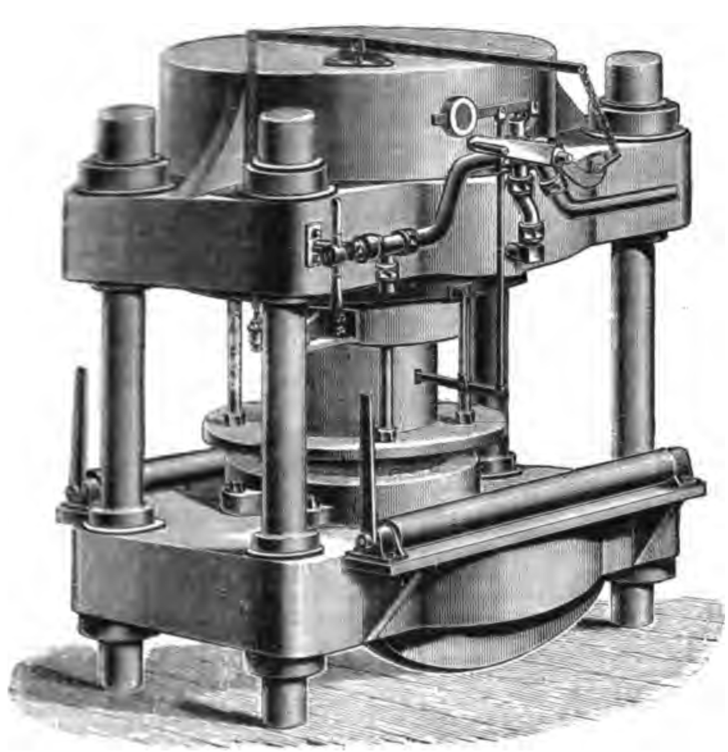


FIG. 1.—CRAIG & DONALD'S MANHOLE PUNCHING MACHINE. (For Description see page 229.)

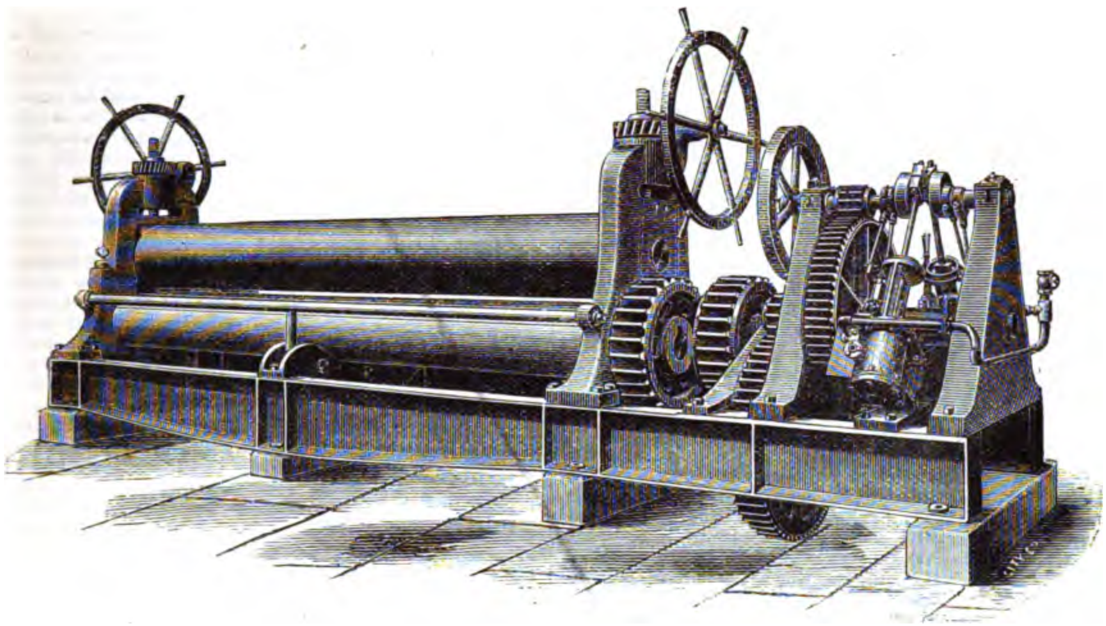


Fig. 2.—BERRY & SON'S HORIZONTAL PLATE BENDING MACHINE. (For Description see page 229.)

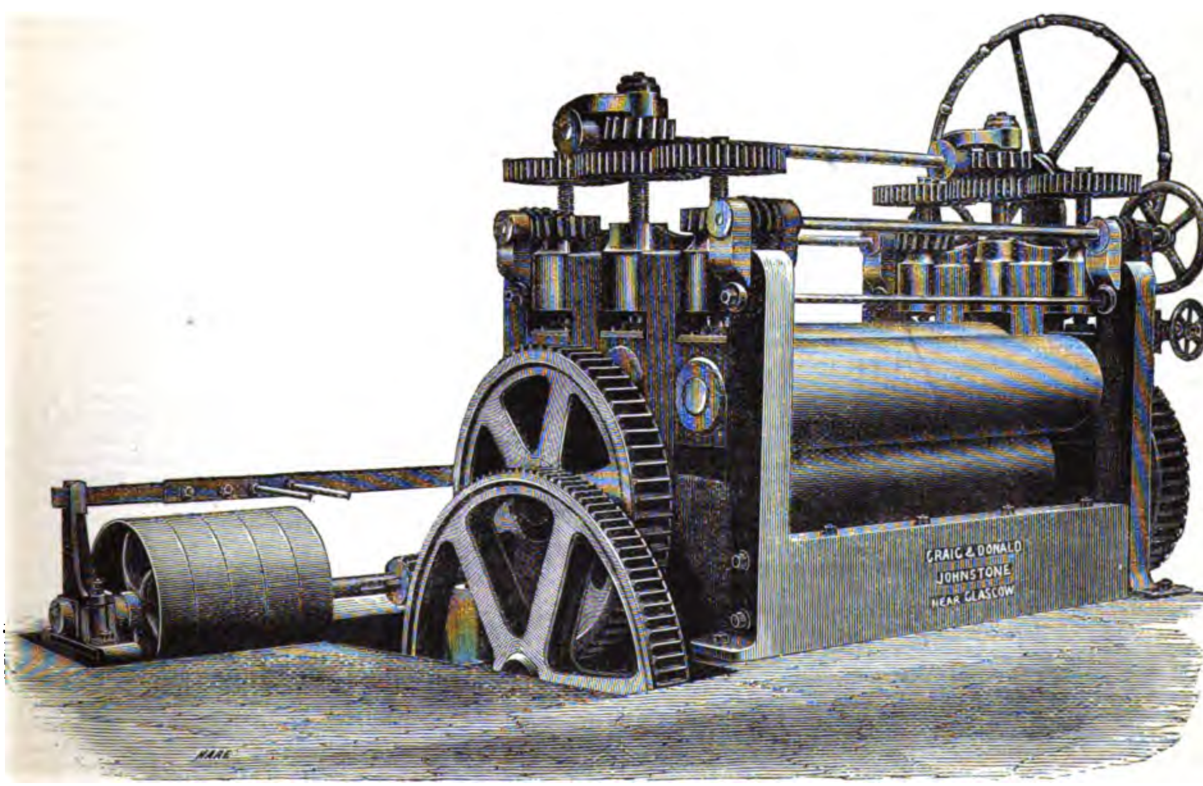


Fig. 3.—CRAIG & DONALD'S PLATE BENDING MACHINE. (For Description see page 229.)

A powerful type of horizontal plate-bending machine has been supplied within the past year to Her Majesty's dockyards at Sheerness and Devonport, and to yards abroad by Messrs. Frances Berry & Sons, of Sowerby Bridge, Yorkshire. These machines (one of which we illustrate on page 231), are capable of bending in the cold state steel plates 18 ft. 6 in. wide up to 1 in. thick. The rollers are of cast iron with wrought iron shafts running through their centres; the top roller being 27 in., and the two bottom rollers 21 in. diameter. These massive and powerful machines are driven by a pair of steam engines with reversing motion, and each weigh about 50 tons. All the gearing is at one end of the machine, thus leaving the outer end entirely clear for the ready removal of cylindrically rolled plates.

The increasing use of long plates in the construction of ships already referred to, and the difficulty of setting perfectly very long plates before previously flattening same, on account of the buckle, which they invariably have, are considerations which have led Messrs. Craig & Donald to design a flattening machine, which will prepare the plates for being dealt with by the long bending rolls. This machine (which we illustrate on page 231), consists of five rollers, carried in housings, and may be simply described as an ordinary plate-bending machine, with two side-top rollers. It is somewhat similar to the seven roller flattening machine, which has been in use for a number of years in most shipyards for treating the thinner plates, but it has some important advantages over this machine. The principal of these is that it does not punish so seriously the heavier plates in use in shipbuilding; that it admits of much more perfect driving gear being introduced, and that it may be used as a bending machine by running the side rollers up clear of the centre top one. This invention may be applied with great advantage to the ordinary shell plate rolls, in which case only one side roller may necessarily be introduced. The principal use of this adaptation would be the bending back of plates, which had been overset, and thus save the expense of hammering, etc. The four roller machine may be used also for flattening, although of course with less satisfactory results than with the five roller machine.

The amount of angle and tee bars requiring to be caulked is now a goodly proportion of the whole, in wooden steamships, especially those with cellular bottoms and minute watertight subdivision, and it is gradually increasing as the evolution in size and complexity in steamship goes on. A machine invented for the purpose of planing the edges of tee and angle bars requiring to be so operated upon, has now been introduced for some time in the yards of Earle's Shipbuilding and Engineering Company, Hull, Sir W. G. Armstrong, Mitchell & Co., Newcastle, and in some of H.M. dockyards. The machine, which is the invention of Mr. White, foreman with Earle's Shipbuilding Company, is manufactured by Scrivan & Co., the notable machine tool makers, at Leeds. The tee or angle bar to be operated upon is fed past the cutting tool of the machine by means of friction rollers, no setting or fixing being required, and the edges of one or both flanges can be planed simultaneously as the bar passes through. The planing can be done square or at any bevel relatively to the flange, the result being a clean sharp edge that will "fay" very closely to whatever it is fitted against, and render caulking easy and perfect. It is to such machine tools as this, possessing labour saving, as well as other qualities, that the greatly improved character of modern shipbuilding work is largely due.

The machine tools employed to manipulate material in the heated state are few in number, and of recent introduction into shipyards. The features requiring to be worked in this condition, as has been pointed out, are not numerous, and, as a rule, do not lend themselves to machine treatment. Within the past two years or so a machine, designed to remedy the inconveniences and imperfections of the ordinary mode of imparting the required bevel to the flanges of frames and reverse frames by hand, has been somewhat extensively introduced into shipyards. This is Arthur's patent angle bevelling machine, experience with which, in several of the largest shipyards on the Clyde and in English ports, shows it to be of considerable advantage to the shipbuilder, both on account of its labour-saving qualities and the superiority of its work. In the ordinary method of bevelling by hand, the appropriate angle to be given to the bar had usually to be first guessed at by the workman, then altered back and forward until it conformed accurately to the bevel obtained from the body plan of the ship. When the bevel was extreme or varied, it followed that the best heat had gone from the bar before it could be bevelled throughout its length. This entailed re-heating once, if not twice or three times, in consequence of which the bar would often become brittle and unsatisfactory, perhaps necessitating rejection altogether. The bars coming safely out of the ordeal were at best unfair on the edges, disfigured by hammer blows, and "hollow backed," *i.e.*, the bevelled flange, instead of being straight from the root of the bar, was produced in a curve. As a result, when the shell plating came to be attached to the frames, the surfaces would not "fay" close or lie solid against each other, rendering the binding unsatisfactory, and sometimes ending in fracture, when attempts were made by the riveters to close up the surfaces with quarter hammers. These drawbacks to hand bevelling had long been appreciated by practical shipbuilders, and attempts to supply a machine to accomplish the work with accuracy and despatch had been made with more or less success from time to time. A machine for this purpose was made and employed by Messrs. R. Napier & Sons for a time, but its use did not become general. As far back as 1871 attempts were made by Mr. Richard Ramage, of Messrs. Ramage and Ferguson, Leith, to produce a machine capable of overtaking all the bevelling necessary on the frames and reverse frames of a ship, but his success was only partial. While his machine could accomplish a uniform bevel throughout the total length of any angle bar, it was not capable of adjusting itself to the varying bevel in individual frames met with at the extremities of vessels. The invention of the bevelling machines now under notice was achieved by Mr. Arthur while employed as a foreman in Messrs. Ramage & Ferguson's works, and the former of these gentlemen, from his previous experience and intimate knowledge of what was required, tendered the inventor every encouragement and assistance in the perfecting of his ideas. Arthur's bevelling machine as completed and now in use, remedies all these imperfections of the ordinary system, and produces clean, smooth, and accurate work. It is mounted on rails in front of the furnace, and when once the end of the bar to be operated upon is inserted between the bevel wheels and rollers, forming a prominent feature of the machine, it is drawn out at a uniform rate, the feeding and bevelling together being done by conical rollers, which are easily adjustable according to the bevel required. On the machine is a dial, worked from the main shaft by a worm wheel, which indicates the travel of the bar through the machine, and therefore of the bevelling spots which are marked and numbered at regular intervals along the bar. What remains for the man in charge is to adjust the bevelling roller by the gearing provided, to the angle corresponding to particular bevelling spot indicated on the dial. In this he is guided by a graduated dial and pointer, connected to the gearing. The time occupied in bevelling is so short that the bar, be it frame or reverse frame, leaves the machine sufficiently hot to be turned to the curve required without re-heating.

A certain proportion of the bottom plates in a ship, *e.g.*, those adjoining the keel, and a few at the stern and elsewhere, have quick bends and twists, which are much more difficult to treat than the easy, generally uniform curvatures on the plates of the bilge. The latter are effected in great measure by the bending rolls, with the plates perfectly cold, but the former have to be made with the plate in the heated state. Hydraulic presses have been used for this purpose for some years, a certain portion of the work done being the manipulation of plates while cold. With steel as the material to be operated upon, these machines are being more and more utilized in this direction, and their presence in the shipyard, as in boiler works, is sure to become more and more prevalent. The operations of the shipyard, in short, have been gaining in exactitude every year, and have borrowed, both in the matters of methods and of appliances, from the marine boiler works, where machine-tools are more conspicuously a feature. Machine tools for riveting, now playing so important a part in shipyards, first had their utility approved of in boiler shops, and the introduction of improved types of drilling machines is largely the reflected successes attending them there. These and other tools, connected with the binding of the structure of ships, will form the subject of a future article.

It is alleged that the French Government have decided to establish a station for torpedo boats at Bona, Algeria. Barracks are to be built there for the accommodation of the crews, and four *torpilleurs* are to be permanently stationed there.

The Darlington Forge Company are at present engaged in the manufacture of a large crankshaft for one of the steamships of the great Japanese line, Nippon Yusen Kaisha, of Yokohama. The crank, which is to be made of Siemens steel, and of the three-throw type, is 27 ft. long, 17 in. in diameter, and of 5 ft. stroke; and will weigh, when finished, about 25 tons.

FORCED DRAUGHT.

(*Continued from page* 196.)

THE advantages to be gained by the adoption of forced combustion in marine boilers, especially where the closed stokehold system is used, may be summed up as follows:—

A more rapid generation of steam is obtained, because the temperature of combustion in the surface and fire-box is much higher than where ordinary combustion takes place, and consequently there is a much greater difference in the temperatures on the two surfaces of all parts exposed to fire and water. As the transfer of heat through a plate varies as the difference of the temperatures of the fluids on either side of it, it follows that the greater this difference is, the greater will be the amount of heat which passes through a unit of heating surface in a given time. The increased rate of combustion per square foot of grate allows of a much smaller area of grate being used to develop a given amount of power. The quicker generation of steam allows of smaller boilers being used for engines of a given I.H.P. This means a decrease in weight, both of the boilers themselves and of the water in them, which is an important consideration, especially in war ships, where the weight of the machinery is reduced to a very low limit. Smaller boilers can be constructed with smaller and thinner plates, and the probable prime cost is less. Forced combustion admits of inferior, and therefore cheaper, coal being used and burnt more efficiently than would otherwise be the case. The supply of air being independent of the direction and force of wind, and of any obstructions that may ordinarily exist to the free passage of air to the stokeholds, the full head of steam can be maintained more regularly and easily, and no thought has to be given to the trimming of cowls to catch the wind.

Again, one of the chief losses of heat in a boiler is caused by radiation from the plates of the boiler. In an open stokehold, the air that is thus heated by radiation escapes in many ways; but in a closed stokehold, its only egress is through the furnace where it is rather beneficial in promoting quicker combustion, owing to its higher temperature.

In closed stokeholds under air pressure, the temperature may be kept almost normal, and the air pure; this enables the stokers to work with greater comfort. Again, if it is desired to change from forced draught to natural draught, beyond opening a few doors, no alteration or removal of gear is required; whereas with other systems of forced draught the same cannot be said. Smaller, and therefore thinner tubes, can be used with forced draught, as they are not so liable to choke with soot; and they do not require cleaning so often as they would under natural draught.

One of the objections lodged against the closed stokehold plan is that a difficulty arises in getting rid of ashes, which, after a few hours' steaming, accumulate so much that they cannot be conveniently kept in the boiler room. To get rid of these ashes, an operation which lasts from twenty to thirty minutes each watch, the stokeholds would have to be unsealed and the fans stopped, which would cause the pressure to fall. This objection has been overcome by having a door at the top and bottom of the ash trunk, one of which is always closed before the other is opened. Another objection is that in cleaning the fires there is no way of shutting off the strong current of cold air from passing into the furnaces and tubes, whereas with other systems of forced draught the blast can be shut off from each fire individually as required. In all systems of forced draught, the air fans with their engines form an important item in the prime cost, and also in the cost for maintenance and working; and the expense of hermetically closing in all the stokeholds and coal bunkers, and the fitting of air locks to make the passage from the outer world into the closed stokehold a pleasant one, is very considerable; but in new ships such structural arrangements can be made as will bring the prime cost of the closed stokehold to the level of that for any of the other systems of forced draught.

Boilers worked under air pressure require greater care in their design, workmanship, and construction; but even with every care bestowed upon them, it is found that they do not last so long as formerly. Much greater skill is required to stoke boilers under forced draught, as it is absolutely necessary to greatly shorten the time during which furnace doors should be open; and as for smoke-box doors, they should never be opened except in cases of extreme urgency. The entire absence at all times of natural light, and the feeling of being boxed in a stokehold, made this system unpopular with the stokers at first; but since the stokeholds have been provided with escape doors that are most easily opened, this feeling has disappeared. The greater comfort an easier work in a closed stokehold under pressure soon make themselves felt, and have led the men to prefer this system of working to even natural draught.

A great drawback with the closed stokehold arrangement is that when working under ordinary natural conditions the temperature of the boiler rooms is very great. This is particularly the case in war ships, where the down draughts are very few in number, and even these are so choked with armour gratings, &c., that no flow of air can be obtained through them by natural means, and the only up draughts are through the furnaces, which are too low to carry off the heated air in the higher parts of the boiler rooms. It can be urged, however, that the fans can be always kept going, even with the hatches open, and under certain conditions they are beneficial; but for very easy steaming, such as is done when a fleet is cruising, and when many of the watches have to be kept with the dampers on the first notch, the use of the fans would have to be greatly restricted. For the fans to be of any use for ventilating purposes they must be driven to exert a small pressure, and it would therefore be very difficult to keep the steam from blowing off if the fans were running.

The practical experience with forced draught has, so far, not been a very happy one, as with scarcely a single exception marine boilers have not been able to work many hours consecutively without requiring either their tubes rolled or seams caulked. In the recent naval operations round the coast, it was found that for making long passages at full speed the modern ships could not compare favourably with those vessels that have not got compound engines or forced draught, simply because the boilers of the former required so much doctoring up to keep them tight. However, compared with the trouble and difficulty experienced in keeping the boilers of the earlier torpedo boats tight—and these were the first marine boilers fitted with forced draught—it would appear that considerable improvement has been made, and there is every reason to believe that with greater care in the design and construction of marine boilers, this improvement will still continue, and that before long the system of using a pressure of air in a closed stokehold to promote combustion, will be universally adopted.

Improvements can be made by reducing the number of seams and joints in boilers. The size of boiler plates made by the steel makers is increasing every day, and some of the go-ahead engineers are erecting rolls capable of bending plates at least double the size of those now in use for boiler making, and also machines for flanging the largest and heaviest plates that it is probable will ever be used in marine work. Everything points to the conclusion that before long the shell will consist, say in a boiler 15 ft. in diameter and 19 ft. long, of three plates only, viz: the barrel in one plate, and the two end plates.

The plan of corrugating furnaces and welding instead of riveting the joint, renders them as nearly perfect as possible, and the only parts of the boiler in which very little progress has been made are the combustion chambers. Recently some boilers have been constructed with the bottoms of these chambers corrugated similarly to the furnaces, and in practice they have given excellent results. All seams in the combustion chambers exposed to fire and flame should be so arranged as to prevent the edges of the plates being acted upon by the direct impact of the flame. Every care should also be taken in designing this part of the boiler, not to have any seams with more than two thicknesses of plate, and even these should be thinned down so as to reduce the total thickness of the joint as much as possible, and the edges chamfered so as not to form shelves or corners in which eddies can be formed, and the gases held in that neighbourhood.

The plates should also be well cleaned of all rust and scale before the joint is riveted, so as to have steel and steel actually in contact, without a film of rust or scale between the two plates. To make the seams at the ends of the furnaces very tight, it is now becoming a common practice with engineers to bore out the flanges in the tube plates to which the furnaces are connected, and to turn the ends of the furnaces in a lathe or other machine so as to accurately fit in them. Several of our leading engineers have already gone beyond this, and turn the fire-box ends of the tubes in a lathe so as to remove all rust and scale, and to make them exactly fit the holes in the tube plates, which are now more carefully and truly bored than when simply drilled. To meet this departure the tubes are now made with staved ends to allow of being turned. Stay tubes, too, are more numerous than with ordinary boilers, the practice in some firms being to have every alternate tube screwed through the plates.

The double-ended boiler is now almost exclusively used for marine work, as, power for power, it is lighter than other types.

With such a boiler, having generally three furnaces at each end, the question of the number of combustion chambers required is an important one Some makers have all six furnaces leading into one large chamber, while others prefer to have each pair of furnaces fitted with a separate combustion chamber. The former plan has the merit of being a lighter and cheaper construction, and with fewer seams to give trouble. It is also assumed by the advocates of this system that any cold air which may find its way into the combustion chamber will be distributed over a larger space, and will not so seriously affect the tubes immediately above the furnace through which the air passed. Where there is only one chamber for all six fires, the act of cleaning one out of the six causes the pressure of steam to fall much more rapidly than if each pair of fires had its separate chamber, and where so much power is concentrated in one boiler as is now usually the case, the fact of cutting out each boiler, or a fourth of the whole, for about twenty minutes during each watch, while the fires are being cleaned, is an important one.

It has been found that the pitch of rivets sanctioned by the authorities for boilers to stand certain pressures under ordinary conditions is too great when forced draught is adopted. The very high temperatures that follow in the wake of forced combustion having a tendency to open the seams between the rivets. As much as possible of the riveting should be done by the hydraulic rams, and the rivets, instead of being heated through a plate over an ordinary forge fire, where the points are heated much more than the rest of the rivets, should be heated in special furnaces that enable the rivet to be heated uniformly throughout, so that when riveted in place, they will completely fill up the holes in both plates as well as having heads formed.

In double ended boilers, the bridges should be carried at least as high as the first row of tubes, so that the currents from two opposite furnaces may be deflected up into the combustion chamber before impinging upon each other. If these currents meet in a line with the furnaces, they become deflected back against the seams of the tube plate, and so cause trouble there. Also, it is possible through the fans not working alike, for a difference to exist in the air pressure at each end of the boiler room, especially in those ships where the passages between and at the sides of the boilers are rather contracted. If in such a case the doors of two opposite furnaces should be open at the same time, a low bridge would admit of a clear run for the current of air from one end of the boiler to the other, resulting in flame, smoke, gas, and small fuel being blown out at the end where there is least pressure. The bridges should therefore be built well up into the combustion chamber, For a similar reason a partition should be built in the middle of the ash-pit, as with a clear run through from end to end, it is possible for the lighter ashes to be blown out at one end into the stokehold.

With forced draught it is essential that larger and more reliable feed pumps should be supplied than with natural draught, as the generation of steam is so much more rapid, and the water therefore disappears more quickly out of the boiler. In closed stokeholds, the whole of the feeding arrangements should be under the immediate control of the person in charge of the boilers, and the feed pumps should therefore be fitted in the boiler rooms. Messages through voice tubes or telegraphs from the boiler rooms to the engine rooms are apt to be misunderstood or not properly attended to; and it is very desirable that in the event of water getting low in the boilers, no delay should occur in putting on the feed.

Safety valve area is another subject that requires consideration. A boiler working at 130 lbs. pressure with forced draught will generate in a given time with an air pressure of 2 inches of water, more than double the weight of steam the same boiler could supply under ordinary conditions, so that the same rule for safety valve area will not apply in both cases, and a new formula must be devised to meet modern requirements.

TENDERS have been accepted by the Admiralty from Mr. Ronald Hunt, of Hammersmith, for his switch-boards and other electric light fittings amounting to £3,000. The Silvertown Company has received an order for sixty search light projectors for the Navy.

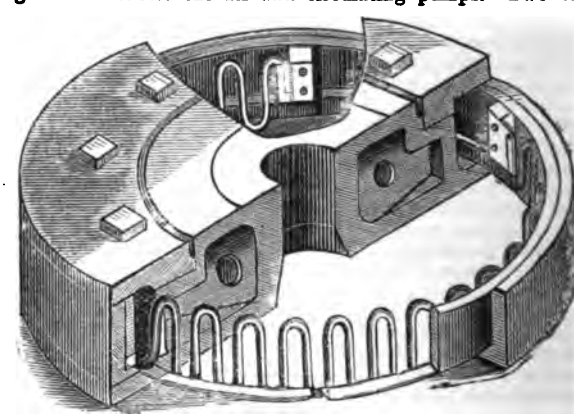
THE completion of the Russian ironclad *Tchesmé* is likely to be delayed, owing to the recent rapid silting at the entrance of the dry dock at Sebastopol. The shoal at the mouth is so large that extensive dredging will be required to fit it for the reception of large vessels. A commission has been sent from St. Petersburgh to inquire into the matter.

THE NEWCASTLE - UPON - TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

JUBILEE YEAR, 1887.

(*Continued from page* 206.)

MESSRS. WIGHAM RICHARDSON & CO., ship, engine, and boiler builders, Low Walker and Wallsend, near Newcastle-upon-Tyne, have a stand devoted to exhibits illustrative of naval architecture, marine engineering, &c., of an interesting character. The *chef d'œuvre* is undoubtedly the ladies' cabin of a steamer, which has been erected, full size, and completely decorated and upholstered—with all the fittings customary in first-class steamers—having folding doors in *Sèvres* style, the upper panels of which are stained glass, the seats covered with blue Utrecht velvet, &c. Among the several ship models exhibited by Messrs. Wigham Richardson & Co., that which attracts most attention is the fully-rigged model of a Transatlantic liner, which is at present in this shipbuilding firm's yard awaiting a purchaser, owing to the financial embarrassments of the Monarch Line, for which it was ordered. This vessel is 400 ft. in length between perpendiculars, 47 ft. 6 in. breadth, moulded, 36 ft. depth, moulded, and 5,000 tons gross register. Equally interesting is the model of the last-mentioned vessel's engines, made to the scale of 1½ in. to the foot. The engines thus represented are to indicate 4,500 H.P., and have some special features. They are of the triple-expansion type, but instead of the pumps being worked off levers as is most usual in engines in the mercantile navy, a separate compound engine, with one high and two low pressure cylinders, is placed at the back of the main engines to actuate the air and circulating pumps. Two bilge



pumps are worked directly off the fore end of the main shaft, and there are separate feed engines and pumps and ballast donkeys. The reversing engine has two cylinders with differential gear, and the turning engine has likewise two cylinders. The model of this engine has only arrived at the Exhibition during the last month, but it is an important addition to the exhibits of Messrs. Wigham Richardson & Co., being finished in every respect complete, the steam vacuum and compound gauges not even being omitted. It has been constructed by Messrs. Rhodes Brothers, of Leeds, who are specialists in model machinery, and certainly reflects great credit to them. The next exhibit of Messrs. Wigham Richardson and Co., we notice, consisted of three of Tweedy and Patterson's piston-rings, intended to be fitted to the engines of a steamer belonging to the Anglo-Australasian Steam Navigation Company, managed by Messrs. William Milburn & Co., of London and Newcastle-on-Tyne. We give an illustration of this patent piston packing which appears to embody an important improvement. The patentees, Mr. John Tweedy and Mr. James Patterson, junr., are members of the firm and staff of the exhibitors respectively, and appear to have been led to design and patent their piston owing to the greatly increased pressure of steam, now in vogue, through the adoption of triple-expansion. It is claimed for Tweedy and Patterson's patent piston that it is the only one that is provided with means for giving independent radial and vertical adjustments, which has a single working ring extending the full depth of the space between the piston and junk ring flanges. As can be readily understood, the ring has a double action and thus requires less pressure to secure the same steam-tightness efficiency.

It may be also pointed out that the outward or radial action of the ring is independent of the vertical action, and each can be adjusted separately, with exactitude, as circumstances may require; while owing to the arrangement of the packing it is not liable to be disturbed in its action, so that increased durability may be anticipated. Tweedy and Patterson's piston ring has already been fitted in about thirty steamers, many of them having triple-expansion engines, and has given satisfaction in each instance, so that it may be reasonably anticipated it will come into more general use. Messrs. Wigham Richardson & Co. also exhibit twelve half-models of steam vessels built by them, of which, owing to pressure on our space, but a brief mention can be made. The paddle river steamer *Sir Herbert Maddock*, is a class of vessel rarely built on the north-east coast, and was constructed in 1864 for the conveyance of troops, &c., on the river Indus. This vessel is 275 ft. long, 28 ft. 6 in. beam, 8 ft. depth, and only 2 ft. 10 in. draught of water, being 508 tons gross register, and 286 tons net register. This vessel, propelled by engines of 300 N.H.P., attained a speed of 15½ miles an hour. Among the other vessels represented by half-models, which have been built by Messrs. Wigham Richardson & Co., are the French passenger steamship *L'Emir*, owned by the Compagnie de Navigation Mixte, the Italian mail steamer *Peloro*, the emigrant transatlantic steamer *Gio Batta Lavarello*, *Nord America*, *Europa*, and *Sud America*, the French mail steamers *Ville de Bone* and *Ville d'Oran*, the paddle steamers *America* and *Georgetown*, the China clipper steamers *China* and *Hindostan*, the Calcutta liner steamship *Socotra*, owned by the British India Steam Navigation Company, and a clipper screw steamer lately sold to Wm. Milburn & Co., Newcastle and London. This vessel is 320 ft. in length between perpendiculars, 38 ft. beam, 28 ft. 8 in. depth, and will be fitted with engines of 2,200 I.H.P. Martin's patent long and short blast fog horn and binnacle had also a resting place at this stand, but it has been recently removed, owing, we understand, to its being experimented with at inopportune moments, to the annoyance of visitors attending the organ recitals in the north court. Possibly it may also have been removed as not being an exhibit of the Walker shipbuilders, as Messrs. Hunting & Pattison, of Newcastle and London, are the sole licensees.

Mr. Thomas Adams, of West Gorton, Manchester, has on his stand a large display of his specialities in patent spring safety valves for all classes of boilers, besides stop valves for marine and land boilers, Bone's patent spring valve for portable engines and steam launch boilers, spiral springs made by patent machinery, and registered design relief valves for engine cylinders and pumps of every description. Most of these specialities are well known to our readers, as they have long held a foremost position, rendering a detailed description unnecessary.

The Darlington Forge Company, Limited, Darlington, have one of the largest stands devoted to forgings, and is worthy of close inspection by all interested in this department. Several of the exhibits are not specially interesting to marine engineers, although every one will view with interest the solid iron crank shaft, 18 in. diameter, constructed for the owners of several iron works, and kept in stock ready for either one of the three firms who use identically the same shaft. A spare built crank shaft for the Cunard Line steamship *Marathon* is also on view, 42 in. stroke, 14 in. diameter. This shaft has a steel crank pin, the main portion of the shaft and webs being of forged iron. The most interesting exhibit of the Darlington Forge Company, Limited, is Putnam's patent flexible crank shaft, of which our illustration gives a side sectional view. The webs are each formed of two 1½ in. plates and four 1 in. plates, all of Siemens-Martin steel, which are shrunk on to the pin and shaft. It will be noticed this crank shaft is for an engine of 3 ft. stroke, but we are not aware that any of these shafts have yet been fitted on board a steamer. The idea apparently is that as the crank pin or the shaft has hitherto been the seats of failures, by giving a degree of flexibility to the webs, the life of a shaft may be lengthened. Certainly it might be anticipated that in case of the shaft getting out of line, &c., warning of the same would be given by the opening up of the webs, but it remains to be seen to what degree this flexible shaft will prove of practical utility. One thing we can say of it, that the workmanship leaves nothing to be desired, the plates forming the webs, being very closely fitted together and a good fit on the pin and shaft ends. The Darlington Forge Company also exhibit a number of models of a turret glacis plate, made for H.M.S. *Victoria*, which is 44 ft. in diameter, and weighs 38 tons. This glacis plate is in fifteen pieces, ten of the larger ones weighing about 3 tons each. The extreme width of this plate is 3 ft. 6 in. and the thickness tapers from 7 in. to 2 in. It is made of forged scrap iron. A model of the forged iron spur plates, as supplied to H.M.S. *Nile* and *Trafalgar* are also shown. Some account of the works of this company may not be without interest. They cover about eight acres of ground, and find employment for nearly 500 men. The forge department contains sixteen steam hammers, from 1 ton to 13 tons in weight, the largest hammer, having a fall of 9 ft. and exerting 117 ft.-tons by gravity, or about 230 tons when steam is admitted at the top of the piston. Special appliances are used for welding large stern frames, and their machine shop which is 300 ft. long, 80 ft. wide, is equipped with all the latest improved tools, and is now busily engaged in the manufacture of very large forgings, both in iron and steel. Steel crank shafts that weigh over 25 tons finished, and stern frames of 17 tons. They are supplying forgings at the present time to Germany, Holland, France, Denmark, Mexico, Japan, America, &c.; for the latter country two large solid crank shafts 18 in. diameter. They have recently added 16 acres of land to their present premises, and are extending their steel manufacture by the addition of a large building of three spans of each 50 ft. wide by 300 ft. long, each supplied with steam travelling cranes of 50 tons lifting power, three large Siemens open hearth furnaces for the purpose of producing ingots and steel castings of any description and of the largest size likely to be required.

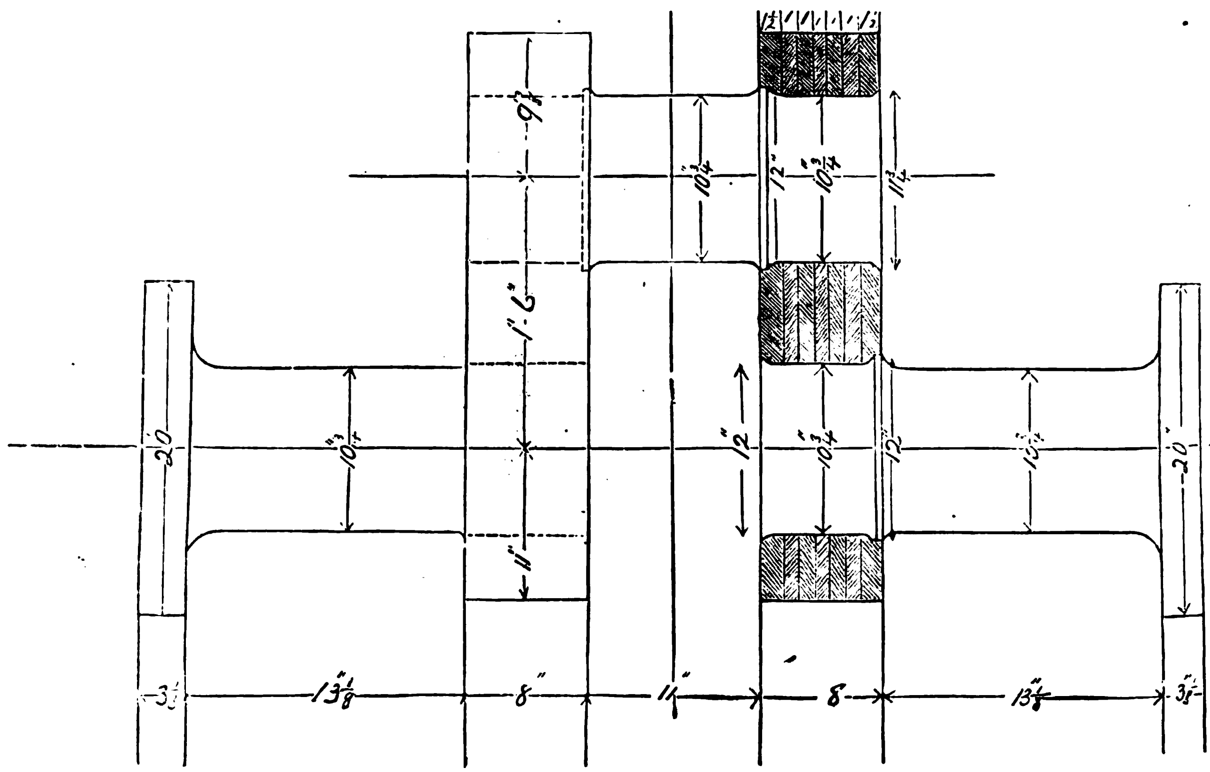
The North-Eastern Steel Company, of Middlesborough, have a large and very varied collection of exhibits, illustrative of basic steel. Although for the present this material has not been much used for shipbuilding and boilermaking, it does seem destined to be a success in these industries, judging from the important nature of this Company's exhibits. For shipbuilding purposes there appears to be little reason why it should not be at once generally used, if it were accepted by Lloyd's Register, as a suitable material worthy of a reduction in scantlings, as compared with iron of ten or fifteen per centum. A number of specimen tests of basic steel plates, arranged on a flanged boiler plate of the same material, range in tensile strength from 23·1 tons to 30·7 tons per square inch, in elongation from 30 per cent. to 23·5 per cent. per 8 in., and in reduction of area from 62 per cent. to 46·6 per cent., show at all events, that basic steel is much more ductile and possesses greater alternate strength than ordinary ship-plate iron. A plate bent cold four-fold is also worthy of special notice, it having a tensile strength of 26 tons, with an elongation in 8 in. of 24 per cent., and with 51·8 per cent. reduction of area. A test of a specimen boiler plate of basic steel is also exhibited, which we see gave 27·26 tons per square inch tensile strength, with 25 per cent. elongation in 8 in., and 46 per cent. reduction of area. There are also a number of sample rivets tested in every imaginable manner, all showing superior qualities of ductility and homogenity. Twisted and tied cold round bars is further evidence of the high quality of this material, and a tensile test of a ⅞ in. round bar we noted gave a breaking strain of 25·2 tons per square inch, with 25 per cent. elongation in 8 in., and 62·7 reduction in area. The basic steel angle-bars must not be overlooked. A portion of one which is shown, flattened and bent whilst cold, gave a breaking strength of 28·96 tons per square inch, with 26 per cent. elongation, and 43·19 per cent. reduction of area. Amongst the numerous exhibits on this stand we noticed a Galloway boiler tube, sleepers and rails, and other railway fittings as supplied to the Indian railways, all of basic steel; also a sample of chain cable made of the same material, of which a portion of a one-inch steel chain cable has been tested to the ultimate tensile strain of 32 tons, as against the Admiralty requirements of 24 tons for the same size and description of iron chain cable. To visitors, generally, the exhibits of basic slag, both as it leaves the converter, and afterwards, when pulverised for manuring purposes, along with the shots of steel extracted from the slag, will prove interesting.

The Consett Iron Company, Limited, of Consett, Durham, have a large and varied collection of articles in their extensive case, illustrative of the manufacture of iron and steel, although the latter material bulks more largely. What appeared to our eyes to be the most unique specimen of steel plate we have as yet seen, illustrating its ductility, is exhibited by the Consett Iron Company. We refer to a plate 15 ft. in length, 36 in. breadth, and $\frac{5}{16}$ of an inch in thickness, which by accident was caught athwart the rolls as it was being inserted for its final planish, and thereby twisted, so that it was creased up into fifteen folds. As the plate at the time was rapidly cooling, it is remarkable that under such a severe pressure no fracture was occasioned. The Consett Iron Company only exhibit among their finished specimens Siemens-Martin steel, but amongst a large selection of pig iron we noticed Bessemer, Hæmatite, and Ferro-Manganese. The collection of ores are principally from the company's

mines, and comprise samples of Bilboa Campanil, Rubrio, Elba, Algerian, and Cleveland ores, and there is also a number of specimen firebricks, coke, &c., manufactured by this enterprising and successful company. A large variety of ordinary tensile, hot and cold bending tests, of Siemens-Martin steel are displayed, the tensile tests varying from 28 to 32 tons per square inch breaking strain, with elongations ranging from 20 to 42 per cent. There are also unusual tests exhibited, which forcibly illustrate the superior character of this approved mild steel. Two plates, ⅜ in.-thick, having ¾ in. holes punched in them, have had these holes gradually increased by inserting punches with a slight taper in the holes already formed, until the holes have been made 1¾ in. in diameter. This was done while the steel plates were perfectly cold, and without the slightest signs of fracture becoming visible. The representative of Messrs. Hawks, Crawshay and Sons has charge of the case of the Consett Iron Company, and is ready to show visitors their exhibits, of which we have only given a brief sketch.

flap nozzle, which has proved successful after lengthened trials. The automatic "re-starting" injector works equally well at all pressures, and is feeding all the boilers at the Newcastle Exhibition. Mr. John Duckitt, Great King Street, Newcastle-on-Tyne, is the local agent and in charge of the exhibits of the Patent Exhaust Steam Injector Company, and we would recommend any of our readers who visit the exhibition, and who are unacquainted with this company's specialities, to spend a few moments in examining them.

Messrs. Amos & Smith, of the Albert Dock Works, Hull, have a very well arranged stand containing a number of their specialities. The most interesting to our readers are their steam steering gears and combined hand and steam steering gears, of which a variety of sizes are shown, as well as two different designs of the latter, one having vertical cylinders and the other, an older design, the cylinders placed horizontally. The vertical cylinder steering gear has been brought out, owing to a frequent demand for one occupying a *minimum* space, but it possesses, at the same time,



THE DARLINGTON FORGE COMPANY, LIMITED. (For Description see page 235.)

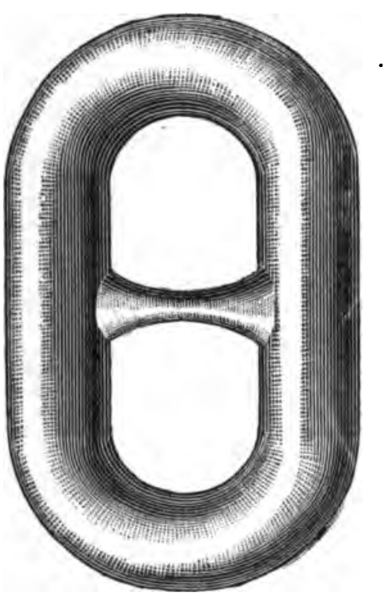
The Patent Exhaust Steam Injector Company, Limited, 4, St. Ann's Square, Manchester, have a stand in the West Court, where they exhibit their specialities, viz., the "exhaust" injector and the "automatic re-starting" injector, patented by Messrs. Hamer, Metcalfe & Davies. It is claimed for the exhaust injector that it is much more economical in working than ordinary ones requiring live steam, and that by the adoption of this patent injector, the steaming power of a boiler is greatly increased. In ordinary working waste steam from the exhaust pipe is taken to the injector, and forces the water into the boiler with regularity, against 75 lbs. pressure, and at the same time heats the feed-water to a temperature of about 190° Fah., thus effecting a saving without the necessity of using feed-water heaters, and at the same time avoiding the back pressure caused by their use. There is also a manifest saving in returning the exhaust steam to the boiler; for higher pressures a special injector is made to work up to 200 lbs. The automatic re-starting injector has been specially designed for steam vessels, locomotives, &c., where the continuity of the jet is liable to be interrupted. Among the advantages of this last mentioned injector is that there is no difficulty in starting nor inability to re-start if stopped, and it is thus strongly recommended for marine work, in which injectors have been frequently a source of annoyance, owing to the want of automatic re-starting. This latter action is obtained by a patent

all the features which have rendered Messrs. Amos and Smith's steering gears popular. The special feature of this gear is that of yielding under the sudden strains imposed by seas striking the rudder, and of immediately returning to its normal position when the strains cease. The combined hand and steam steering gear has a good feature, viz., that whether the hand or the steam arrangement is being used, the same number of turns of the wheel have to be made to put the vessel over to port or starboard, so that it is impossible for a deck-hand, even if he is entirely ignorant of the mechanism of a steam engine, to do the gear an injury. We need add nothing in commendation of these gears. Messrs. Amos & Smith also show a model of their digging excavator—possibly interesting to some of our readers—but of which pressure of space precludes a description.

The Metallic Valve Company, 69, Tower Buildings, Water Street, Liverpool, exhibit their well-known successful specialities, viz., Kinghorn's patent metallic flexible valves, and Kinghorn's patent multiplex disc valve. Besides showing samples of new valves, they also have on view at their stand valves which have done good service, and seem little the worse for wear. Amongst the latter we notice an air pump valve, which had been in constant work in the s.s. *Plantain*, for 3½ years; another which had been for the same period in the s.s. *Merton Hall*, and one which had been five years in the s.s. *Cumeragh*. Such facts as these speak far

more highly for metallic valves than any mere theoretical opinions, although it may be incidentally mentioned that they were awarded the first prize silver medal at the North-East Coast Exhibition, 1882, and Inventions Exhibition, London, 1885. Messrs. Danson & Scott, 3, St. Nicholas Buildings, Newcastle-on-Tyne, are the local agents for the Metallic Valve Company.

Mr. William Penman, of Gateshead, who has recently invented and patented a process for casting chain cables, shackles, eyes, hooks, railway couplings, intricate smithwork, &c., of steel, also has a stand in the North Court. The operation of casting is carried out in cast-iron moulds, the casting being subsequently annealed by the patentee's special process. Up to the present time the sole makers of Penman's patent weldless chains, &c., has been Messrs. John Spencer & Sons, Newburn Steel Works, a firm which has a long standing for casting steel stern frames, stems, crank shaft webs, besides many minor articles—and it shows that there is apparently a great future for Mr. Penman's patent when such a distinguished firm has taken up the manufacturing of chain cables, &c., by his process. In fig. 1 we show the form of one of Penman's weldless studded links—and it will be seen that the stud is much less in thickness than the cast-iron ones, merely contracted into welded links, although, as it is united to the fibre of the main part of the link, it is not liable to spring out, as is the case with the stud in an ordinary chain cable when a heavy strain has to be taken. There is thus not only a saving of weight, but, as we learn from authentic tests, some of which we



will quote, a great gain in efficiency, and it is anticipated that when once the superiority of these steel chain cables, as manufactured by Penman's patent, is realized by the committee of Lloyd's Register, there will be a further saving in substituting these steel chain cables of smaller sizes for forged iron ones of the sizes required by their rules. It is only reasonable that lighter steel chain cables, having the same strength as now required by the Admiralty and Lloyd's requirements for heavier forged iron chain cables, should be accepted on their merits. Samples of a number of Penman's patent chain cable-links tested in conjunction with ordinary forged ones at the River Wear Commissioners' Public Chain and Anchor Testing Establishments, Sunderland, are shown; and out of a large number tested at various dates we select a few examples. A 2⅛ in. ordinary steel link chain cable connected to a 2 in. Penman patent link *without stud* was put in tension until a strain of 130 tons was applied, when the former parted near the weld, leaving the patent link in position only slightly fractured in the inside. The overproof on the stud link when parted was 60½ per cent., and on the patent link 80½ per cent., thus showing 20 per cent. in favour of the patent link *without parting*. The results of testing other three samples of chains, made in accordance with Penman's patent, must suffice. Two of these were railway coupling links of 1¼ in. diameter, one of which was tested and parted at 57 tons, equal to 205 per cent. above the Admiralty proof for 1¼ in. close link chains, and the other only parting at 66 tons, or 242 per cent. above the Admiralty requirements. So far we have been quoting the results of testing Penman's patent steel chain cables, of which the links were not provided with studs, but in this last test we quote the links had studs, not merely jambed in as in the iron cable, but cast along with the link, the advantage of which will be seen by the result obtained. A 2 in. studded Penman's weldless link was tested along with a 2⅛ in. best studded cable link, forged in the very best manner, and the latter parted, while the patent link was so slightly fractured that the writer found it impossible to discover a flaw, proving that a 2 in. steel chain cable, manufactured by Penman's patent, is superior to a 2⅛ in. ordinary chain cable of the best manufacture. The breaking strain for a 2 in. ordinary studded chain cable is 100·8 tons, while this 2 in. Penman's patent chain cable was only barely fractured, if at all, at 136 tons. The domain of steel castings is evidently being largely increased, and we may expect a corresponding diminution in the work of the forge-master. Hitherto it has been principally large forgings that have been substituted with steel castings; now it is apparent that in minor branches, such as angle-iron smith work, anchor and chain manufacture, that cast steel will take the place of forged iron. The numerous exhibits of small castings, all of the clearest and apparently ductile and homogeneous character, which are exhibited by Mr. Penman, are evidence that the days of "forgings" are numbered, and seeing the great difficulties attaching to intricate smith-work, and the dangers of unsound welds, we are by no means surprised.

Messrs. B. S. Bagnall & Sons, of Winlaton, have their exhibits on the next stand, and they comprise samples of crane chains, sling chains, cage chains, saddlery chains, shackles, thimbles, hanks, &c., as well as samples of iron and chain, tested to destruction. All the articles exhibited by this firm bear evidence of having been carefully manufactured, and the whole make up a very creditable display.

The Credenda Cold Drawn Seamless Steel Tube Company, of Ledsam Street, Birmingham, have a large number of exhibits of their special cold-drawn seamless steel tubes, manufactured to combine strength with lightness, for engineering and scientific purposes, of which we cannot say more than that they appear to be admirably adapted for their intended purposes.

Messrs. Taylor Brothers & Co., of the Clarence Iron Works, Leeds, have a very large stand, to which we cannot do justice. The great majority of their exhibits relate to locomotive engineering, there being a number of cranks, axles, wheels, cast steel boiler seatings, &c., but not much of interest to the readers of our journal, if we omit the samples of Yorkshire boiler plate and angle iron.

Messrs. Crewdson, Hardy & Co., of the Yorkshire Tube Works, Middlesbrough, have an effectively arranged stand, containing wrought iron welded gas, steam, water and hydraulic tubes and fittings, steel tubes, taper core bars, &c. We were particularly pleased with one of this firm's exhibits, which consisted of a coil of 2 in. piping about 2 ft. in diameter, the length of piping reaching to 70 ft.

Next we come to the stand of the Anchor Tube Company, of Gas Street and Berkley Street, Birmingham. Their exhibits, although consisting only of tubes, are not without their interest to our readers. This company manufactures lap-welded boiler tubes of both wrought iron and homogeneous steel, and show both black and galvanized boiler tubes, steam and gas tubes, in large numbers.

We must pass over the following companies, who in some instances have large stands, as not containing objects of sufficient interest to justify more than a passing notice, although the mere mention of their names will testify to the general importance of their exhibits. We refer to the Winlaton Nut and Bolt Company, of Winlaton; the Tredegar Iron and Coal Company, Limited, Tredegar, South Wales; the Weardale Iron and Coal Company, Spennymoor; and the Darlington Steel and Iron Company, Limited, Darlington.

American Steam Navigation.—There are now lines of American steamers running to Cuba, Venezuela, and ports in Central America, as well as to Brazil and ports on the Pacific. Another 3,000-ton iron steamer is about to be contracted for by the United States and Brazil Steamship Company.

A ship canal from the Thames, near Woolwich, and the Albert Docks, to Newhaven, is proposed by Mr. H. W. Grylls, and the proposal is said to be received with favour. The country to be passed through is supposed to be easy and not costly, but no surveys have been made.

RECENT LIFE-SAVING INVENTIONS.

THE interest evinced at present in the question of increasing and improving the appliances for saving life at sea, leads us to refer at some length to several important inventions having this end in view, which have recently been subjected to the test of actual practice. As is now well known, the Commission on Saving Life at Sea has urged the lifeboat capacity on board mail and passenger ships to be increased 100 per cent., but shipbuilders and shipowners have experienced difficulty in augmenting the number of boats, owing to a scarcity of deck space available. To overcome this, Mr. Robert Chambers, late shipbuilder, of Dumbarton, has invented a new type of lifeboat, which, as it seems to fulfil the highly important end in view, as well as embody several novel features, merits attention.

A full-sized boat, built to Mr. Chambers' design, was subjected to a series of experiments before a large gathering of experts, at the entrance to Messrs. D. & W. Henderson's wet dock, Partick, on the 2nd of September. The distinguishing feature in this new type of lifeboat is its small depth when stowed aboard ship. It forms an amalgamation of the ordinary style of wood construction, and the collapsible canvas method. The lower portion is, of course, the rigid part, and the upper works are of strong waterproof canvas, stretched over an inner framework of malleable iron stanchions and stays, arranged so as to be collapsible and lie flat on top of the rigid part, when the boat is housed on board ship. By means of this amalgamation the designer is enabled to have all the advantages, and it is claimed more than the efficiency, of the ordinary lifeboat, while, at the same time, as many as four boats can be stored in the space usually occupied by one of the ordinary type. The boats can be stowed in tiers one above the other, the deck area occupied being the same as in the case of an ordinary boat, while the present system of lowering and launching by davits need not be altered nor increased. The boat with which the trials have just been made is 26 ft. long, 7 ft. wide, and 18 in. deep to the fixed gunwale, but with the canvas upperworks erect, 3 ft. 4 in. The weight of the boat is only 17½ cwt., or about one half the weight of a boat constructed in the ordinary fashion. Internally, the space is sub-divided into as many as 44 air-tight compartments, affording the quality of buoyancy to the extent of 3 tons 7 cwt. There is accommodation for 40 or more passengers, and the thwarts, while serving the purpose of seats, are fitted underneath with tanks, intended for the stowage of water, provisions and distress signals.

At the trials on the 2nd inst., with 38 full-grown men on board, the lifeboat had only a draught of 12½ in., leaving 5½ in. freeboard to the fixed gunwale, and 2 ft. 3½ in. to the canvas gunwale. Loaded in this condition, the boat was rowed round the entrance to the dock, and then at the instigation of Capt. Price, of the Board of Trade, who was present, she was made to oscillate violently from side to side, with the object of capsizing her. The rolling was so great, that at times the canvas gunwale was brought to within four or five inches of the water. This left nothing to be desired as regards the boat's great stability.

The structure of the boat is of great strength and uniformly watertight. The outer shell consists of a double thickness of yellow pine, one thickness acting as the strap connecting the planks of the other thickness. A layer of prepared canvas is fitted between the two thicknesses. A longitudinal bulkhead of 1½ in. pine, made watertight, is fitted from end to end on each side, and similar athwartship bulkheads cut off the bow and stern into small compartments. A series of watertight partitions subdivide the sides of the vessel into 40 compartments. It will thus be seen that ample provision is made for any mishap in the way of the shell being stove in, either in launching or by floating wreckage. Mr. Chambers claims that his lifeboat is absolutely unsinkable by any of the mishaps ordinarily attending lifeboats at sea. This is so far in advance of what is claimed for the ordinary lifeboat, built and equipped to Board of Trade requirement, that hesitancy in accepting the claim is natural until some crucial test of the boat's behaviour in actual shipwreck has taken place.

However this may be, the inventor has, with commendable thoroughness, so designed the lifeboat, that in the event of its being capsized, either at launching or in the open sea, it can be easily righted. This is contributed to by the form of the hull and the disposition of the air-tight buoyant compartments, as well as by strong wood hand-grips arranged along each side of the keel, and by loops of cordage along the gunwale. In any contingency the bottom of the lifeboat is so formed as to constitute a raft upon which a large number of passengers might cling for life with a reasonable prospect of being saved.

Altogether, we are of opinion that this new lifeboat is an improvement on the ordinary type favoured by the Board of Trade, and a distinct advance upon the efforts to provide for the full complement of passengers, which consist in the supply of collapsible canvas boats. The *raison d'être* of these craft is their convenience in stowage, but in Chambers' semi-collapsible boat this is sufficiently attained, at the same time that all the efficiency and strength of an ordinary lifeboat are secured. We hope to see boats of this new type adopted by some of our enterprising steamship companies, and the actual experience with them resulting in their approval by the Board of Trade, the Admiralty, and shipowners at large.

Another notable invention intended to minimize the loss of life at sea, which has been recently tried, is that by Mr. McConnachy, of Port Glasgow, which consists in adapting the gangways which span the spaces between poop, deckhouses, and forecastle of a ship, as life saving appliances in cases of disaster at sea. They were first fitted on board the ship *Altmore*, built by Messrs. Robert Duncan & Co., Port Glasgow, for Messrs. Thom and Cameron, Glasgow, which sailed in July last. The same builders are just finishing a large sailing ship, the *Oceana*, for Mr. R. R. Paterson, Greenock, and these patent gangways form part of the deck fittings of this efficiently equipped vessel. In order to test the appliance thoroughly, the inventor (Mr. McConnachy) on September 17th had two of these gangways (which are 18 ft. long) placed in the water side by side, about 2 ft. apart, and connected by cross rods of iron at the extremities, the space between the gangways being covered by a plank the same length—thus constituting a raft 18 ft. in length by 8 ft. broad. Each gangway is fitted with three rowlocks on each side, so that when two are placed in position in the manner above described, the raft can be rowed with six oars. On the 17th September it was manned by six rowers, with Mr. McConnachy and one of the builders of the *Oceana* steering, which is very easily and effectively done by means of an oar. They set out from Port Glasgow and rowed to the Tail of the Bank, sailing round the vessels of the Channel Fleet and causing no small sensation amongst the sailors and visitors, who seemed to take some interest in the novel craft as it glided swiftly along from one vessel to another. The day being calm on the river, the waves of the passing steamers were the nearest approach to a "sea" experienced by the voyageurs during their trip, but even that was sufficient to show the buoyancy and stability of the raft, which could with perfect comfort hold 20 persons. On returning from the cruise the raft was taken asunder and the gangways which formed it were placed in their respective positions on board the *Oceana*, to span the spaces between the deck erections and serve the purposes of bridges for officers and crew. They are fixed in their places by means of slip bolts which, in cases of emergency, can in an instant be withdrawn, thus freeing the gangway and making it available as a life-saving raft. There can be no question that this making the most ordinary deck fittings of vessels serve the purpose of life-saving appliances will have a very sensible effect in reducing the loss of life at sea.

FERRY STEAMERS FOR THAMES TRAFFIC.

ON Friday last the directors, of whom Admiral Sir E. Inglefill is chairman, visited the two new ferry boats building at Messrs. Steward & Latham's, Upper Ford, Brick Ford, Millwall, for the purpose of inspecting the progress of the work. The dimensions of the steamers, which are for vehicular as well as passenger traffic, are as follows:—120 ft. by 40 ft., with a draught of 6 ft., and are to ply from South and North Greenwich; they will be propelled by twin screws, loop ends, so that they may be the easier handled. They are built entirely of Siemens-Martin mild steel, and will no doubt be a great acquisition to owners of every description, as well as a great boon to the working classes. The directors, after expressing themselves as greatly pleased, both with the forward state of the vessels as well as the quality of workmanship, and thanking the firm for the kindness shown them, left for London.

THE Greenwich Hospital pension of £50 a year, for chief engineers, has been conferred on Mr. George Crichton, in the room of the late Mr. Thomas Brown, inspector of machinery.

THE D. C. GREEN COMPRESSED AIR INDUCED DRAUGHT SYSTEM.

THIS is a system of extreme simplicity in conception, practically carried out in plain inexpensive forms, with wider applications than perhaps have yet been suggested; and the late Mr. D. C. Green, the inventor, may be imagined as having thought, that if a nozzle could be devised, which by spring or otherwise would automatically adapt itself to certain steady currents, first of compressed air from an air compressor, and second of induced air from the atmosphere as a follower of the compressed air, the invention would be in various ways useful and highly economical. Whether or not this was his line of inventive thought, his invention is just of such a nozzle, which, once devised and perfected, as it now is, becomes available, by means of cocks and gas piping, for pumping air, pure or foul, from remote recesses, and delivering or discharging it at desired distances. The general utility of the invention is thus obvious. For a number of purposes it gives us an air pump as efficient as the motive power and as the volume of the air. For the present the nozzle is made in four sizes, with inlet pipes of 2½ in., 1½ in., 1¼ in., and 1 in. in diameter. The 1½ in. nozzle will pass nearly 80 cubic feet of air per minute at a pressure of 5 lbs. to the square inch, which is the pressure ordinarily employed, and will induce a following current of 2,000 cubic feet per minute. The power of the 1¼ in. nozzle is rather more than one-half of this, and that of the 1 in. nozzle is about one-third as much. The air issues from the nozzle in an annular jet, the width varying as the pressure. This is provided for by means of a movable body in the centre of the jet, which balances itself between the pressure of the air and the resistance of a spring. When the air pressure rises, this body, moving outwards, expands an orifice, and on the contrary, when the air pressure falls, there is a contraction of an orifice, the end being to keep the air discharge of the jet constant, even with the air compressor working at unsteady speeds. The nozzle is fitted in a pipe of greater diameter, and at a short distance in front the bore of the pipe is gradually contracted and then expanded to increase the inducing or following current. These, the perfected supplemental details towards the better working of the nozzle, form, with an elaborate system of gas-pipe conduits, the D. C. Green air compression draught.

As a system of ventilation, where compactness is only a secondary consideration to fresh air, it is not likely to be soon supplanted by another. Such compactness is essential on board ship, and accordingly its ship utility is being increasingly recognized. One of the earliest endorsements for ship's use was from the Leven shipyard, Dumbarton, Mr. William Denny commending the system in warm terms. The Govan shipyard of Messrs. John Elder & Co., less effusive, made the statement that the system had been adopted on board the *Umbria* and *Etruria*, and that it had been found efficient. The North German Lloyd Company speak of the system as furnishing fresh air to all rooms and compartments, when extended throughout a vessel, and recommend it to all shipowners on the broad ground that they have adopted it on their ships the *Oder*, *Neckar*, *Aller*, *Trave*, *Saale*, *Preussen*, *Bayern*, and *Sachsen*. But the official report of the United States Naval Department, as a technical testimonial, is the one best calculated to advance the adoption of the invention. At page 4 we find:—"If the pump or air compressor should change the quantity of air supplied in a given time the nozzle will move automatically to a new position, which will give exactly the area required to discharge the new rate of supply under the same pressure." Again, at page 5:—"When the pump or air compressor delivered the same quantity, in equal time, of the same compressed air directly into the compartment without passing through the nozzle—for which experiment provision had been made in the apparatus—the difference of effect was very marked, the ventilation being greatly poorer and the pressure in the compartment falling lower than was required to turn the anemometer, which accordingly remained motionless. In fact, with the same expenditure of power and the same compression of air in the same pump or air compressor, both as regards density and bulk, twenty-six times the volume of fresh air was thrown into the compartment when the nozzle was used in connection with the pump or air compressor than when the latter alone was used. The whole of the additional twenty-five volumes was clear gain, and cost absolutely nothing beyond the cost of producing the one volume by the direct action of the pump or air compressor. It is, of course, possible to ventilate with a blower; but, economically, it is inferior to the system of injecting nozzles, requiring a much greater expenditure of power, and very much bulkier piping." To the report, the well-known names are appended of B. F. Isherwood, Theo. Teller, Henry L. Snyder, and Wm. H. Shock, all chief engineers of the United States Navy.

For the adoption of the system an air compressor is placed in any convenient position, and no greater pressure is generally necessary than from three to five pounds per square inch. The compressed air is then conveyed in gas pipes to the patent automatic multiplying air nozzles, which are fixed at the different points where the ventilation is required. As remarked before, the air from the nozzles passes into a specially prepared pipe, where it receives from the atmosphere an induced or following current 20 to 30 times greater in volume than the compressed air. This induced or following current may be drawn from any distance, so that nozzles may be fixed in remote parts of ships, buildings, mines, or tunnels, and made to draw fresh air from the most convenient place by continuing a light sheet iron or wood pipe to the open air. In addition to the injecting nozzles, suction or exhausting nozzles are provided, and it should be added especially in connection with ships that for deodorizing and disinfecting purposes the injecting nozzles may deliver air charged with chemicals either in a cold or heated form. This last use on board ship has already proved of great sanitary value.

Two sister turret ships are about to be laid down in Cronstadt, for the Black Sea. Their displacement will be 8,000 tons. For protection of the centre of the ship and machinery steel armour 20 in. thick will be used, decreasing to 10 in. towards the extremities. The breastwork and turret armour will be 16 in. They will be armed with two 12 in. guns in each turret, and will carry in addition four 9 in. guns, eight Gatlings, and a torpedo apparatus.

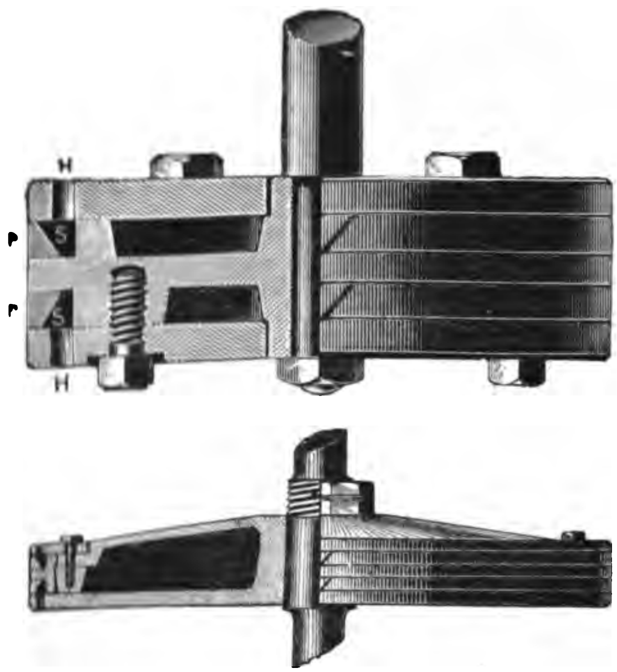
SMALLEY'S PATENT PISTON.

DURING a recent visit to Liverpool we were afforded an opportunity of inspecting a piston patented by Mr. Smalley, and manufactured by Messrs. Smalley, Rice and Evans, of 41, Stanhope Street, Liverpool, and which, as it appears to possess several advantages rendering it peculiarly applicable for use with marine engines, we now have pleasure in describing.

With this piston there are no springs or V pieces to break or get out of order, the rings being kept up to the cylinder face by the pressure of steam.

This total absence of springs allows of the piston being put into the cylinder with the greatest ease, and also ensures perfect freedom of movement within the cylinder.

The piston consists, as will be seen from the accompanying illustration, of the usual hollow casting forming the top and bottom heads. These are closed some little



distance in from the periphery by a ring bolted in and fitting steam tight. Outside this ring is a second ring of ⊢ section, the horizontal arm of which divides the periphery for some distance in into a top and bottom chamber, and it is in these chambers that the packing rings, turned up on their outer faces to fit the cylinder, lie.

A number of holes around the top and bottom heads admit steam into respectively the top and bottom chambers, so forcing the rings outwards, according as the piston is on its down or up stroke, and thus it will be seen that one set of rings is brought into play on the down stroke and the other set on the up stroke, the friction being thereby reduced to a minimum, and doubling the life of the rings as compared with the ordinary arrangement of springs. These rings have been thoroughly tested (for months) in engines using steam ranging from 80 lbs. to 240 lbs. pressure per square inch, and in all cases with the greatest success. To demonstrate practically the tightness of the piston, the makers caused the cover to be taken off one end of a cylinder, and then, having turned on steam of 110 lbs. pressure (the crank being chocked up to prevent movement), no sign of a leak past the piston was observable.

It was found on substituting one of these pistons for another taken out (in excellent condition) of a 16 in. cylinder that the same amount of work could be got through when cutting off 6 in. earlier in the stroke than could be done with the former piston, a fact speaking volumes for its economy of fuel.

Its fewness of parts and consequent non liability to derangement render it specially suitable for balance pistons and air pump buckets, one ring only being required in either case, while the very slight wear shown by the rings after long running point to them as being well adapted for use in steam winches and other similar engines where economy of steam is not perhaps as much looked after as it should be. The immunity from breakage that these rings enjoy is best accounted for from the fact that they receive support from the walls of the cylinder, the pressure being internal, while the alternate tight and slack effect produced by the admission of steam first to one ring and then the other ensures a thorough cleansing effect, and does away with that most fruitful source of damage to a cylinder, viz.: "scouring," which is always to be found where a constantly tight ring is used.

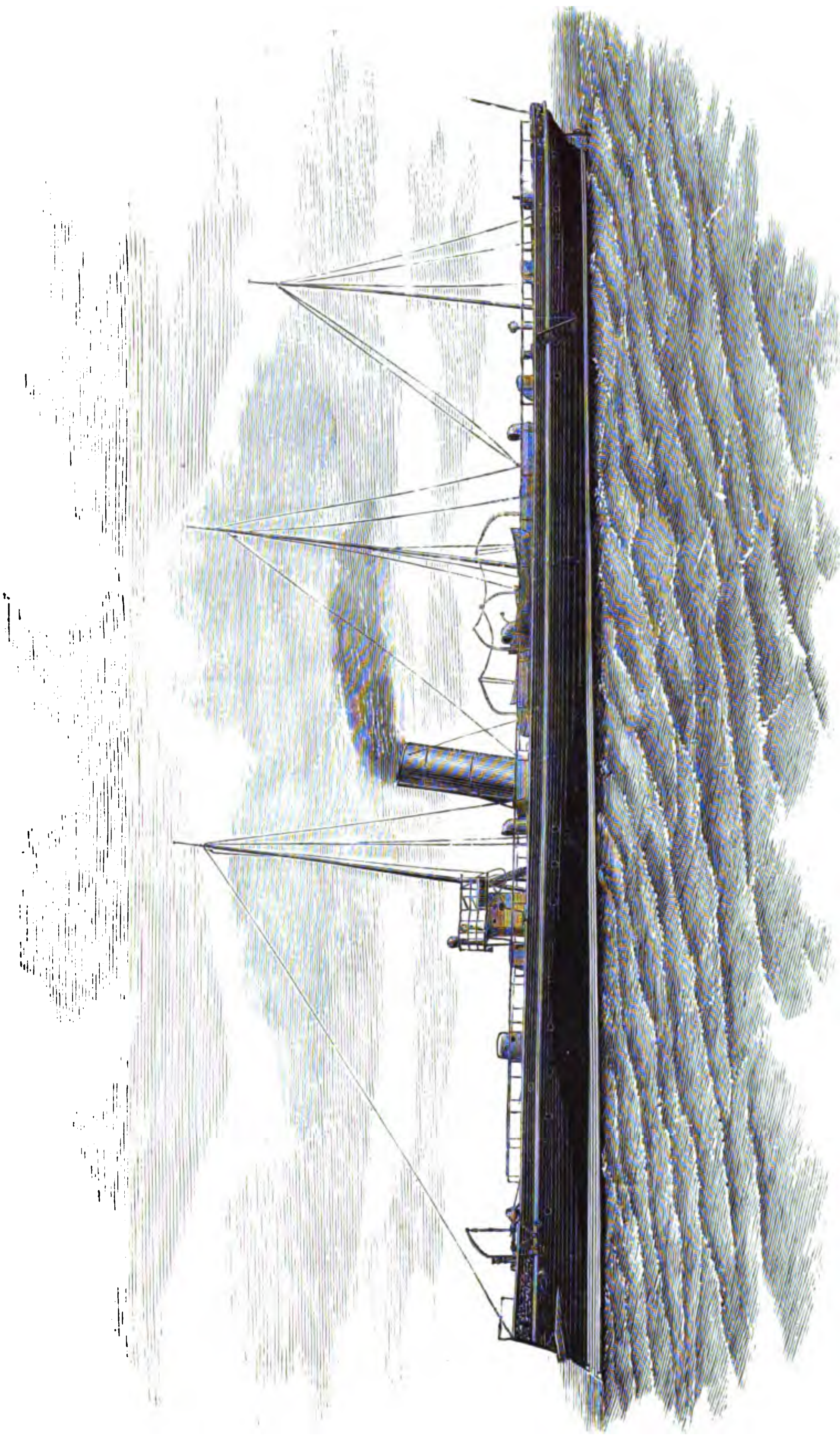
The general concensus of opinion, gathered from a large number of testimonials that the makers have laid before us, appears to be that these pistons are doing their work most admirably, and that too with, in every case, a decided saving in fuel compared with other pistons which they have replaced.

We would specially commend this piston to ship owners to whom economy of fuel and endurance of material of machinery means so much.

MR. J. SAMUEL WHITE, of East Cowes, has received an order from the Indian Government for three 124 ft. first-class torpedo boats, built according to his patent "turnabout" system. They are to be similar in most respects to those constructed by him last year for Her Majesty's Navy. They will, however, be fitted with triple-expansion engines, and the speed is to be 20 knots when fully equipped for sea.

HONOURS AT THE HAVRE EXHIBITION.—The awards have just been made by the jurors, and the following honours have been conferred on firms on the North-East coast:—Consett Iron Company, diploma of honour; Messrs. W. G. Armstrong, Mitchell & Co., for shipbuilding, diploma and gold medal; Darlington Forge Company, for forgings, diploma and gold medal; Messrs. H. S. Edwards & Co., shipbuilders, Howdon, diploma and silver medal; and Messrs. R. & W. Hawthorn, Leslie & Co., Hebburn, shipbuilders and engineers, diploma and silver medal.

H.M.S. "AURORA."—This ship, the last of the seven belted cruisers that have been built for H.M. Navy during the past year, will be launched at Pembroke dockyard, about the 28th October. After having her launching cradles removed, she will be towed to Devonport to have her machinery fitted on board. Ships built at Pembroke have hitherto had their engines and boilers erected on board at that place; but owing to the *Aurora's* boilers being so large and heavy, each one weighing about 55 tons without slings, and there being no sheer legs strong enough to lift them, this work will have to be done at Devonport. Messrs. J. and G. Thomson, of Clydebank, who are engining the *Aurora*, have despatched the whole of the boilers and machinery to Devonport dockyard, where they are to be stored in the custody of the chief engineer of the yard, until the vessel itself is brought round from Pembroke. The engines are contracted to develop 8,500 I.H.P., and are of the triple-expansion type.



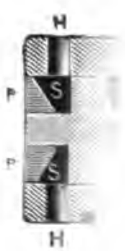
THE AUSTRO-HUNGARIAN TORPEDO CATCHER, "METEOR."

BUILT BY HERR F. SCHICHAU, ELBING.

(For Description see page 241.)

SMALLEY'S

DURING a recent
an opportunity
Mr. Smalley, and m
and Evans, of 41,
as it appears to
peculiarly applica
have pleasure in
With this pist
break or get out
cylinder face by
This total a
put into the
ensures perfec
The piston
panying illus
the top and

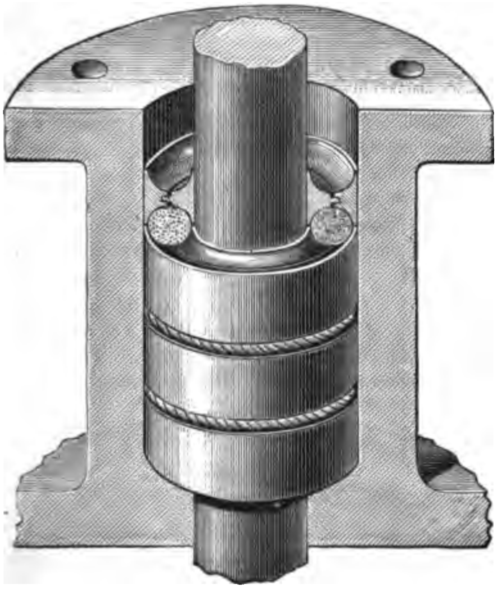


distan
fitting
of ⊢
periph
chamb
rings,
A nu
admit st
bers, so
piston i
seen that
stroke an
being the
life of the
ment of s
tested (for
30 lbs. to 2
cases with th
cally the tigh

BAIRD'S PATENT METALLIC PACKING.

THE accompanying illustrations represent a new form of metallic packing (designed to be used in combination with the ordinary flexible packing) patented by Mr. Baird, and recently introduced by Messrs. Boult Bros. & Co., of 38A, King William Street, London, and elsewhere.

As will be seen, each section of the packing consists of an inner and outer ring, each formed in two segments, and the whole placed so as to break joints. The rings are formed with semicircular channels on their top and



bottom faces. In the channel so formed a turn of soft packing is placed, which, when the gland is screwed up, serves the double purpose of forcing the inner and outer rings apart, so closing one on the rod and the other to the wall of the stuffing box, and also filling the spaces between the inner and outer rings and the butts of the segments.

It will thus be seen that Baird's packing possesses the elasticity of the flexible packing with the endurance of the best metallic packing, a great advantage over both being that the conformation of the metal rings serves to shield and protect the soft packing from the hardening effects of the hot steam, and at the same time presenting a smooth and easy working surface to the rod. The inner rings, on which alone the friction comes, are made of a special bronze mixture, unless other anti-friction metal is specified. The first ring inserted forms an efficient neck brass which closes up any play between the rod and cylinder cover, so preventing the packing being ground through into the cylinder. No special fitting of the stuffing box is required, provision being made for drawing the rings from the box by means of an opening at the butts of the inner rings, through which a hook-pointed picker may be inserted.

Should it be desired to obtain additional elasticity, one turn of a spiral spring may be placed between the rings at the bottom of the stuffing box instead of the turn of soft packing.

We understand that these rings are giving satisfaction wherever fitted, and certainly their simplicity ought to win for them the favourable notice of ship-owners who may require an efficient packing at a reasonable price, and applicable alike to piston or pump rods.

THE AUSTRO-HUNGARIAN TORPEDO CATCHER "METEOR."

THE accompanying full page illustration represents a vessel, 57 metres in length and 6·8 metres in breadth, recently built by Herr F. Schichau, of Elbing, for the Austro-Hungarian Government, and specially designed to allow of her attaining the highest speed when required to chase torpedo craft. The vessel, which made her final trial on the 25th of August, is now lying in the open sea off Pillau, with full war equipment on board, and carrying coals for a run of 2,600 nautical miles, at a mean speed of 10 knots.

The speed during the one hour's trial, and against a wind with a pressure of 4, was equivalent to an average throughout of 23·1 knots, 26·6 statute miles. The vessel, when loaded, has a displacement of 420 tons, and the capacity of her bunkers enables her to carry coal sufficient to supply the highly economical type of engines with which she is fitted (and for which her builder is celebrated) for a run of 6,500 nautical miles without re-coaling, a most highly satisfactory state of things, and equalled by few, if any, vessels of her class.

The boiler and engines are entirely protected by the coal-bunkers, these being also supplemented by steel armour, and when running at full speed no vibration is perceptible; in fact, the vessel is perfectly steady and no head waves are created, two most valuable qualifications from a gun platform and marksman's point of view.

The combustion in the boiler is excellent, Schichau's patent furnace being used, a system which permits of the stokers working in fresh air, in fact, during the trial the skylights were opened. It is also worthy of notice that with this system, and when running under forced draught, very little smoke escapes through the funnel, and then only on rare occasions.

The engines worked absolutely without fault, both during the trip of one hour, and the forced-draught trial of four hours; the Imperial Austrian Commission who subsequently took the vessel over expressing admiration with its performances throughout.

The *Meteor*, which from our illustration will be seen to present a far more pleasing and symmetrical appearance than generally obtains with this class of vessel, makes, when having coal on board for a run of 1,000 nautical miles, 25 knots, by the measured mile, and will be, by the time this is published, homeward bound for Pola with an Austrian crew on board.

JOY'S VALVE GEAR.

We have pleasure in correcting a mis-statement of our correspondent, which appeared in our last issue, as to the reported breakdown of the valve gear (Joy's patent) on board the *Amphion* at the Jubilee review. We have since learned that the breakdown on this vessel occurred in the air pump, and not in the valve gear, and we have been authoritatively informed that the Joy's valve gear "worked very well during the whole of the steaming and had nothing at all the matter with it." From a letter also, which we publish in our correspondence columns, from Messrs. Alex. Wilson & Co., it would appear that those qualified by experience of Joy's valve gear, think very highly of its strength, simplicity, and durability. As to its efficiency for more perfect cut-off during expansion, its merits have long been recognized by all.

Upon further enquiry as to the general favour or otherwise in which Joy's valve gear and other radial gears are held, we find that their adoption seems to be largely increasing. Of the Joy valve gear alone we understand that applications have been made up to over 150,000 I.H.P. in marine engines, and to over 800 I.H.P. in locomotives. As we are desirous of presenting facts and accurate results as far as possible in engineering matters to our readers, we should be glad if any of our readers would send us their personal experience with these gears. which we should be glad to publish in our correspondence columns.

The valve gear upon the *Narcissus*, referred to in the same paragraph as having broken down, was not Joy's patent.

REID'S METALLIC VALVE.

Messrs. William Reid & Co., of 45, Fenchurch Street, London; 3, Queen Street, Newcastle-on-Tyne; and 2, India Buildings, Liverpool, are the sole licensees and manufacturers of the metallic valve, as shown in the illustrations, for air circulating, and feed pumps, which dispenses with spindle, and stud, and screw. These are high recommendations, and contrast favourably with the utter absence of good qualities so noticeable in various valves in common use; the long lift in some valves is, in that respect, a waste of power, and when that is found coupled with a superfluous spindle which may stick, besides a valve form which seems to offer the maximum resistance to the passage of steam or water, the marvel is that the uses of such things can hold their own under the fierce competition of the time. Nowadays simplicity, with durability of material, and reliable constant action, is becoming more and more essential in the marine fit-up, and according to present lights, this particular valve leaves nothing to be desired. The brass, as the gun metal of its construction, when gun metal is used, is sound and tenacious, and highly finished. Working with small lift, in self-contained form, under an equal strain upon all parts, the maximum of durability is assured. In short, the valve is an invention of great merit and is certain to be adopted generally by engineers.

The first illustration (Fig. 1) is of the valve in its open form, the lower part being the seat, and the upper part the guard. The two distinct openings, or outlets, will allow more steam or water to pass than usual, and the valve proper being rounded, friction is reduced to zero. In other words, the shape of the valve proper will economize power through the easy action of the pumps. Obviously also, the inlet and outlet area is exceptionally large, which is a point of prime importance for high pressure working. So much indeed is the advantage in this respect, that a 4 in. valve of this form is equal in capacity to a 6 in. valve of those often met with in use.

Fig. 1.

The second illustration (fig. 2) is of the valve in its closed form, showing extreme compactness, fine proportions, and high capacity. By taking off the guard, the valve may be reversed, and the lift altered; and it is all but superfluous to add, that the valve will work equally well in a horizontal or vertical position. The valves are sent out complete with guards and seatings.

Fig. 2.

THE NEW ROATH DOCK AT CARDIFF.

THE NEW COAL CRANES.

THE New Cranes for shipping coal, two of which have been erected on the south side of the Roath Dock, and for which a patent has been obtained by Sir William Thomas Lewis, the Manager of the Bute Dock Company, are exciting a good deal of attention among local colliery proprietors, shippers, and shipowners. South Wales steam coal is known to be very brittle; it contains large quantities of gas necessary for combustion, and when broken the gas escapes, and to that extent the coal deteriorates in value. It is therefore desirable to transmit the coal as carefully as possible from the pit's mouth to the merchant's depôt. This is recognised even at the Northern shipping ports, and in some places the shoot through which the coal passes from the wagon to the vessel's hold is bent to check the force with which the coal rolls down, as it is in this rolling that the coal is often much broken. At the New Roath Dock in Cardiff the coal is brought down to the crane in ten-ton wagons, and is quietly tipped into an iron box or hopper which stands on a trolley sunk below the level of the wagon. The hopper, which is capable of holding ten or eleven tons of coal, is then lifted by the crane, swung round, and lowered into the vessel's hold until it reaches the floor, when a chain allows the bottom of the box to remain, the sides are drawn up, and the coal falls out gently in a heap round the hopper. The bottom, which is cone-shaped, is then drawn through the heap of coal, and the hopper is swung round and lowered for another supply. So nicely does the machinery work that were the hopper filled with glass bottles they could be loaded in the vessel's hold without being broken. While the hopper is being swung round, and lowered into the hold of the vessel, the empty coal wagon has been sent away, and a loaded one is ready in its place when the hopper returns. As the hopper can be lowered to any part of the hold, a good deal of time now occupied in trimming the cargo will be saved, and as coal owners very freely blame the coal trimmers for the broken coal this liability will be reduced.

It is computed that half a million of money would be annually realized by the sale of South Wales steam coal where it placed in the hands of the foreign merchants large. In some of the countries of the South of Europe the manufacture of patent fuel is not known, and there are thousands upon thousands of tons of small coal at these places that is valueless, the cost of freightage of which has had to be paid by the foreign merchant. Therefore, the lesser the quantity of small coal turned out with each cargo, the greater the value of that coal. Coal shipped at these cranes will very soon be at a premium, and in the competition that will arise in the shipment of coal, when the Barry Dock is opened, the loading of vessels by the new system will form a very important element, and there can be no doubt that coal shipped at the Roath Dock will command the highest price in the foreign market. The new cranes have opened up the whole question as to the best method of shipping coal, and there is little doubt that in a short time important changes will be introduced into the modes of bringing it down and shipping it. The fact that in the 900,000 tons increase in the shipment of coal this year over the same period of time last year from all ports in the country, Cardiff and Newport have absorbed nearly the whole of that increase, will induce the colliery owners of South Wales to maintain a position which they have secured solely by the superior quality of the South Wales coal, and the quality of that coal can be best maintained by placing it in the foreign market as nearly as possible in the condition in which it is found in the colliery.

OPENING OF A NEW DRY DOCK AND WHARF AT NEWPORT.

ON Wednesday, September 14th, a new graving dock and wharf situate on the east side of the River Usk, was formally opened for public use. The ceremony of opening the works consisted firstly in the laying of the last coping stone of the dock by Mrs. Heard (wife of the chairman of the directors), accompanied by the Misses Heard, and the admission of the first ship on the blocks. The stone was placed in position, and Mrs. Heard having spread the cement and struck the stone declared, amidst the cheers of the spectators, that it was properly laid. Mrs. Heard was presented with an artistically engraved silver trowel by the engineer (Mr. T. Rees), and with a splendid mallet by the contractor (Mr. Godfrey).

The first steamer to enter the dock was the *Thomas Coats*, owned by the Messrs. Beynon of the port. The vessel was light, 220 ft. in length, with a forward draught of 7 ft. 3 in., and aft 11 ft. She passed into the dock at 2·30 p.m., and as she broke the ribbons across the entrance hearty rounds of cheering were given by the crowds who thronged the adjacent wharves, and a continuous discharge of fog signals on the line of railways and at the works.

The Newport Slipway, Dry Dock and Engineering Company, Limited, who have just opened the above important private graving dock, was formed three years ago, in order to provide better accommodation for the needs of the great number of steamers frequenting Newport, consequent upon the opening of the Alexandra Docks, which has caused the trade of the port to expand four-fold within the last 10 years, and which hitherto had not been able to get the needful dock room in order to effect their repairs, the consequence being that a great number of them were driven to Cardiff, and even to Bristol, to accomplish what Newport, at that time, was totally unable to provide. The Company acquired 24 acres of land on the east side immediately opposite the new entrance to the Alexandra Docks, and at once proceeded to build their dock. The first sod was cut on the 11th March, 1885, and the construction has proceeded slowly but surely, many difficulties of various kinds being encountered in the course of its construction. The Company carried their foundations down to a depth of 40 ft., so that they should rest on the marlrock, a good foundation being naturally of the very highest importance. The walls are 14 ft. thick at the base, tapering up to 5 ft. at the top. All the stone was brought from the splendid quarries which exist on the River Wye, and it was dressed upon the Company's premises. Since the dock has been in course of construction, the Great Western Railway Co. have passed a bill for a line of railway, expressly for the development of the east side of the river, and this railway will pass within 100 yards of the Company's premises, from which naturally they will derive an immense advantage.

The position of the dock altogether is most favourable, being situated just in the bight or bend of the sea reach, where the water is slack and no danger whatever can accrue to steamers entering the dock; moreover the entrance is protected by two fine wooden piers 106 ft. and 166 ft. long respectively, the width between their heads being 220 ft.

The dimensions of the dock are 350 ft. in length, 77 ft. wide at the top, 54 ft. at the bottom. The entrance (which is protected by a fine steel and wrought iron rolling caisson built by the Company themselves upon their own premises) is 55 ft. wide, and there is a depth of 22 ft. 6 in. upon the sills at ordinary tides, ranging up to over 30 ft. at springs, so that it will be seen that this dock is capable of receiving a very large steamer upon any tide throughout the whole year, and moreover, can take in any ship that is able to enter the Alexandra Dock both as regards length and draft of water.

Close to the dock is a very fine wharf at present used for discharging ballast by steam cranes. This wharf is intended to

be devoted to the convenience of steamers waiting for docking, as minor repairs can be conducted there without less of time preparatory to docking.

The entire river frontage possessed by this Company is probably unequalled in the United Kingdom, namely, 1,850 ft. continuous wharfage, with 600 ft. backlet. The value of such a property in London, Liverpool, or Glasgow, could only be measured by a very large sum of money indeed.

The Directors originally were:—T. Beynon, Esq., J.P., of Bryn Ivor Hall, Chairman; E. J. Grice, Esq., J. P., The Fields; W. E. Heard, Esq., J.P., Machen House, (senior partner of the firm of G. W. Jones, Heard & Co.); G. Inglis Jones, Esq., Maindee Park, steamship owner. Subsequently Mr. Beynon vacated the chair through ill hea'th, and the office then devolved upon Mr. W. E. Heard, under whose management the dock has been brought to a successful issue.

Success cannot fail to attend the enterprise because there are only two other private docks on the river, and they are not only smaller, but have a much less draft of water than the Eastern Dock. The company have announced their intention of retaining their works upon their private wharf, which is near to the head of the Alexandra Dock, and also their works at Sharpness Dock, thereby enabling them to have, as it were, three strings to their bow.

The general manager is Mr. G. F. Mason, a Liverpool gentleman who had charge of the Canada Docks there, where he has had, as may naturally be supposed, a great and very valuable experience.

The work has been carried out by Mr. G. B. Godfrey, contractor, of Westminster, from the design of Mr. Oscar Reichenbach, of Westminster, and Mr. T. Rees, the engineer of Newport. The resident engineer is Mr. W. P. Davies, and the contractor's agent Mr. L. H. Cochrane.

After the opening ceremonial a large and influential company sat down to luncheon in a spacious iron building near the works. Mr. W. E. Heard, the chairman of the Company, presided. Amongst those present were Sir George Elliott, Bart., M.P., Mr. G. Hoskins (Mayor), Mrs. Heard and the Misses Heard, Mr. Godfrey (contractor) and Mrs. Godfrey, Colonel Lyne, Capt. Parfitt, Mr. E. J. Grice, Mr. Alderman T. Beynon, Mr. T. Rees, Mr. T. J. Benyon, Mr. M. Mordey, Mr. G. Kendall (Lloyd's surveyor), Mr. K. H. Foote (harbour master), Mr. H. W. Cooke (Anchor Line), Mr. J. Moxon, Mr. A. O. Jones, Mr. J. H. Winn, Mr. Young (London), and others.

After the usual loyal toast, Mr. Godfrey gave "The Town and Trade of Newport." He said he hoped that the increase of the trade of Newport would affect himself. He believed that there was a great hope for the future of Newport. The toast was coupled with the names of Sir George Elliott, Bart., M.P., and Alderman T. Beynon.

Sir George Elliott in acknowledging the toast, said he had a strong and an abiding confidence in the inherent qualities of the people and the town of Newport, and its river. He felt sure there was a great future for Newport, and that there was no place he knew of like that immediate locality for the prosecution of the particular business to which it was devoted. Alderman Beynon also responded to the toast, and remarked that that dock was not one which was constructed out of rivalry to any other dock, but simply to meet a felt want.

Other toasts followed.

THE EXPLOSION ON BOARD THE "ELBE."

On September 19th one of the most disastrous marine explosions recorded took place about 4 p.m. on board the *Elbe*. The main steam pipe gave way, and nine men in the stokehole at the time lost their lives, while a tenth, greviously scalded, lies in hospital. The *Elbe* is a vessel of about 3,000 tons, the property of the Royal Mail Company. She was built 17 years ago at Glasgow by Messrs. Elder & Co. Recently she has been overhauled by Messrs. Oswald, Mordaunt & Co., of Southampton, and fitted with triple-expansion engines capable of indicating about 3,500 H.P. Last month the ship made a preliminary run in Stokes Bay. Some modifications were found to be necessary in the engines, and these were made, and on September 19th she undertook her official trials. The cylinders are 32 in., 50 in., and 80 in., or thereabouts, in diameter, the working pressure being 160 lb., and the revolutions about 60 per minute. The boilers, eight in number, are fired athwart ship, and a transverse bunker cuts them off from the engine room. A straight steampipe runs the length of the stokehole, united to each boiler by branch pipes and T-pieces, each boiler having a stop valve on it; the steam pipes are of copper. On Monday, September 19th, during the first and second runs on the measured mile, the tail rod of one of the cylinders heated, so the trial was brought to an end for a time; the stuffing box gland was taken out and filed larger in the hole by the staff on board, and replaced. The ship then went on the mile again, with results wholly satisfactory. When turning at the end of the fourth run, the main steam pipe burst. It was on the underside of the pipe, so that the steam was all directed downward into the stokehole, access to which could only be obtained from the deck by three flights of most difficult, narrow, perpendicular ladders. As the rush of steam occurred right above the crooked passage through the transverse bunker, escape in that direction was cut off. The consequence of the tremendous rush of steam which followed was the death of those in the stokehole at the time—Mr. Thompson and Mr. Ewing, the first and second engineers; a boilermaker, Godber, one of Messrs. Oswald & Co's engineers, and three firemen and two coal trimmers. There was a large number of engineers and visitors in the engine-room at the time, but they suffered no inconvenience. Although the door in the narrow passage through the transverse bunker already named was open, it is a curious fact that through this door, and also down the windsails, a steady inrush of air was maintained all through, the steam rising in volumes from the gratings and other outlets and blowing away to leeward. No one could enter the stokehole for nearly two hours. After about an hour, one brave fellow had himself slung on a rope and attempted to descend the aft stokehole ladder. He got down as far as the second landing, and there found poor Thompson dead. He had succeeded apparently in getting so far when he was overtaken and overpowered by the suffocating steam. The rescuer could do nothing, being nearly suffocated himself, and had to be hauled up. All this time the engines kept on turning, working on the vacuum. Tugs at last came alongside, and the bodies were sent on shore, while the ship was towed back to Southampton water.

The pipe was a brazed copper pipe, 10 in. diameter, and No. 2 B.W.G., or just over quarter an inch thick, corresponding to a stress of about 3,200 lbs. per square inch, so that there was a very large factor of safety. The pipe had been tested to double the working pressure more than once. The bursting strain on it per inch of section was 800 lb., and $\frac{800}{x}$, where x is the thickness of the pipe, gives the actual tensile stress. Thus, x being quarter of an inch, the stress would be 3,200. The strength of good copper is about 33,000 lbs. per square inch, at a low temperature; but it must be borne in mind that it is exceedingly difficult to get good copper now, the market being flooded with a very brittle and inferior foreign copper. At high temperature copper loses its strength very rapidly. The temperature of steam of 160 lbs. on the gauge is 375 deg., and a pipe conveying this steam would lose about 15 per cent. of its strength.

A NEW TYPE OF STEAMER FOR RIVER WORK.

On September 17th, Messrs. Steward and Latham launched from their lower yard (South Dock Iron Works, Blackwall), a somewhat novel steamer, viz., a combination of tug and lighter, 72 ft. by 16 ft. by 5 ft., and is built to carry from 70 to 80 tons of cargo, being fitted with all the necessary gear for towing purposes; she is to have combined winch windlass, the former for loading and unloading cargo, the latter for speedily raising anchor and getting on the way. This vessel, which will at all times be capable of carrying the above cargo with or against the tide, will also be useful in picking up and towing any craft that may be waiting removal. There is no doubt that such a vessel, possessing these combined advantages, will be found a most useful, economical, and profitable investment; in fact, she is just the steamer the Kentish farmers have so long been talking about, carrying a good freight herself, and being able, with her light draught, to run into harbour or alongside of wharf and take in tow any other craft that may be loaded wanting conveyance to the London markets. She is built to the order of the well-known firm of Beresford and Co., St. Olive's Wharf, Rotherhithe, whom we wish every success in their new enterprise, as there is no doubt this is the step in the right direction. She is a strongly-built steamer, and a credit to the builders, and when at work no doubt great interest will be taken in her. We are fully assured that other owners of craft are awake to the value of such a vessel.

ATLANTIC STEAM NAVIGATION.

IN the unavoidable absence of Mr. Johns, the Naval Constructor of the Barrow Shipbuilding Company, a paper was read on Saturday evening last, at the American Exhibition, "On Atlantic Steam Navigation," by Mr. B. Martell, Chief Surveyor of Lloyd's Register of Shipping. Mr. Martell held to the belief that speed beyond that attained by the *Umbria* and the *Etruria* is a matter of time; but he did not express an opinion as to the form in which acceleration should, or would be sought. Nor did this come out in the discussion which followed the reading of the paper, although several engineers spoke at length. This is to be regretted. The points on which attention for the moment turns are, first, the maximum strength of cylinders, and the maximum strength of boilers, and steam pipes, the presumption being that forms, proportions, angles of entrance and clearance, and lines are a somewhat exhausted direction of trial and enquiry. As regards cylinders, in the earlier days of the Cunard service, when steam was not employed at a higher pressure than two atmospheres, cylinders were cast at five to six tons tensile, with this consequence, that Sandy Hook was made in from 14 to 16 days. Later on, say in the *Scotia* period of the Cunard service, there was still no greater cylinder strength than five to six tons tensile, nor any use of steam beyond two atmospheres; but by economies in the use of steam, Sandy Hook was made in from 12 to 14 days. Then, all of a sudden, we come upon the period of Atlantic racers, the cylinders of the *Umbria* and *Etruria*, and other ships, being cast from the foundry cupola up to 15 tons tensile, and steam used up to nearly six atmospheres, on the average of the cylinders of triple-expansion, with Sandy Hook made in say six days. Then, there is a Glasgow secret process, which has been in operation for 25 years, which recently cast the torpedoes for harbour defence, which has cast propellers for the Dundee whalers for 14 years, and which has been largely entrusted with the castings for British lighthouses; that system makes castings, of all sections, from the foundry cupola, up to 28 tons tensile. At this point, the subject may be left for the consideration it deserves, Mr. Martell being amply justified in the expectation of increased Atlantic speed, when cylinders of 28 tons tensile may now be substituted for those in present use at 15 tons, these latter reducing the duration of an Atlantic voyage to six days. Query: What would be the Sandy Hook time with 28 tons tensile cylinders?

Mr. Martell said that he was not in a happy position as the apologist for the unavoidable absence of Mr. William Johns. Urgent business, coupled with indisposition, had prevented Mr. Johns from fulfilling his engagement. To show the progress of naval architecture and engineering, in Atlantic steam navigation, it is only necessary to direct attention to the rude specimens of the American aborigines which you see before you, and to compare them with the latest specimens of transatlantic steamers, models of which are to be seen in the main court of this building. The development has involved much scientific knowledge and practical application, but only, be it remarked, to a large extent over half a century. Men are still living, and some are present in this room, who were witnesses of the early experimental applications of steam to wooden hulls. Anything like rapidity of communication, and regularity of service, between this country and America, was unattainable until steam became the motive power, and it will be remembered how such men as Dr. Lardner doubted the utility and efficiency of steam propulsion even after its adoption. As for ever crossing the Atlantic by steam propulsion, the attempt was regarded a presumption, and the men who thought of it denounced as dreamers, theorists, and worse, no later than fifty years since. It was not until the paddle steamers, *Sirius* and *Great Western*, had crossed the Atlantic, the former in 15 days, and the latter in 17 days, that the marine engineer had a chance. Since 1838, steady progress has been made in the steam propulsion of vessels, and now instead of 15 to 17 days to perform the voyage, it is accomplished in little more than 6 days. Need I add, that it is confidently hoped, that within a very short period, even the six days will be diminished. Taking something like the chronological order of development, in 1840, the *Britannia*, belonging to the Cunard Company, made her first voyage at a speed of about 8½ knots. Other paddle steamers of the same class were built by the Cunard Company, their length being little more than 200 feet, and their tonnage about 1,100 feet. Then came the Inman line, the first steamer of which, the *City of Glasgow*, with a tonnage of 1,600, was fitted with the first screw propeller, which crossed the Atlantic. That was as recently as 1850. In 1874, the White Star Line gave the greatest impetus to transatlantic navigation, Messrs. Harland & Wolff launching the *Britannic* and the *Germanic*. These vessels were far in advance of all their predecessors, and were of the following dimensions: length, 455 ft.; breadth, 45 ft. 2 in.; depth, 33 ft. 7 in.; tonnage gross, 5,004; and 760 H.P. The average time occupied by these vessels was a little over eight days, and it was not until the construction of the *Arizona*, five years later, that the time was sensibly diminished. Since then, a strong feeling of competition has prevailed among the companies, resulting as a commencement in the construction of the sister ships the *Umbria* and *Etruria* by Messrs. John Elder & Co. The length of each of those ships is 501 ft. 6 in.; breadth, 57 ft. 2 in., depth, 38 ft. 2 in.; tonnage gross, 7,718. The greatest speed attained by either of those vessels is somewhat in excess of 17 knots, or 20 miles an hour, which is the ordinary speed of trains upon our railways. This is a time of little more than six days against the early times of 15 and 17 days.

Notwithstanding this great progress, British progress still asserts itself. At the present time, there are in course of construction, for the Atlantic trade, steamers approximating to the enormous size of 9,000 tons. The I.H.P. of these newer steamers will be correspondingly increased, so that it is not too much to anticipate that the voyage will be accomplished in less than six days. The principal requirements for steamers to be engaged in the Atlantic service appear to be: 1, great strength; 2, speed; 3, safety by transverse and longitudinal bulkheads; and 4, comfort. For strength, the naval architect can now provide against all possible strains, even in the worst weather of the Atlantic. For speed, this can now be pretty nearly calculated, particularly where economy of space and consumption of fuel are of minor importance. The new steamers in course of construction will be fitted with triple-expansion engines, and will be run with much fuel economy. For safety, there is the provision of watertight bulkheads, in such number, that the filling of one, or even two, will not destroy flotation. The practical difficulty hitherto has been the large space required for the engines and boilers, but by transverse bulkheads with the engines and boiler rooms placed longitudinally, the difficulty is overcome. Facility is also afforded by the adoption of twin screws. As regards the comfort provided on board the recently-constructed Atlantic steamers, it is lavish. At the same time, it is deserving of consideration whether the time has not come when separate cabins should be provided. This would add immeasurably to the comfort of a numerous class who dislike sleeping in the same room with strangers. This, doubtless, will be done eventually, and why not on board such enormous steamers as are now being constructed?

Finally, when we consider the advantages which may arise from forced draught, and the general adoption of triple steam expansion, it is not giving expression to an over sanguine feeling, when it is asserted, that steamers may yet be constructed for the Atlantic trade which will be much faster than those at present in existence. The passenger trade to America is of a magnitude which is a sufficient inducement to the designer to gain this end, as it may be stated that during 1885 no fewer than 55,160 saloon passengers and 281,270 steerage passengers were landed at New York. Moreover, this great trade is on the increase, and naturally, with new expectations of speed, and personal privacy as the highest form of personal comfort. An animated discussion followed, and the proceedings closed with a vote of thanks.

TRIAL TRIP OF A PETROLEUM STEAMER.

THERE has been recently launched from the Low Walker shipbuilding yard of Messrs. Sir W. G. Armstrong, Mitchell and Co., the steamer *Ville de Calais*, which has been specially built for the carriage of crude petroleum in bulk, and which is, we believe, the first steamer of the kind that has ever been specially constructed for this purpose. The *Ville de Calais* is built of steel to the highest class Veritas, and is capable of carrying 2,400 tons deadweight on less than 18 ft. draught. She is sub-divided by a longitudinal and athwartship bulkheads, into numerous cells or compartments, each of which has its own expansion chamber, which latter also forms a receptacle for the gases which are evolved from the cargo. These arrangements in this vessel are of a very special description—petroleum, in its crude state, being much more volatile than refined; for this reason, also, the general construction of the hull and workmanship had to be treated more like boilerwork than ordinary shipbuilding; and before launching each compartment was tested with water, having a head pressure considerably in excess of

what would be sustained in ordinary working. There is a very complete installation of pumps on the Worthington system, both for discharging the cargo and equalizing at will the amount contained in the various compartments. The machinery is on the triple-expansion system, by the Wallsend Slipway and Engineering Company, and during her trial on September 8th worked with perfect smoothness and without the slightest hitch. The vessel was fully laden with water to the contract draught, and obtained a speed of 10 knots. On September 10th she sailed to Calais, where she has since arrived, all well, after a good run. The whole of the vessel's arrangements are of the most complete description, including a full electric light installation by Messrs. Clarke, Chapman, Parsons & Co. Sir W. G. Armstrong, Mitchell & Co. have given the construction of petroleum steamers their special attention, and the *Ville de Calais* is the fourth tank steamer delivered by them this year, the previous vessels being the *Minister Maybach* of 3,300 tons deadweight, the *Hans and Kurt* of 2,800 tons deadweight, and the *Willkommen* of 4,000 tons deadweight. The same builders have yet another vessel in hand in an early stage of construction.

GLASGOW.—MARINE ENGINEERS' UNION.

A MEETING of those favourable to the formation of a Glasgow branch of the above Union was held on Wednesday, the 21st of September, in the Christian Association Rooms, Norfolk-street, Glasgow. Mr. Alexander R. Leask, C.E., Hon. Sec., in the course of an explanatory address, stated that the Union, though only some four months in existence, had already an aggregate membership of some 700, and it was expected that that number would, in the course of a few weeks, be augmented to 1,000, or one-tenth of what was calculated would be the ultimate membership—viz., 10,000. Besides their first union—the Tower branch, London—branches had been established at Liverpool, Newport, Antwerp, and Hamburg, while arrangements were in progress for the opening of another London section at Poplar. Each of the divisions named had already obtained a large membership, and were supplied with fully-equipped clubhouses. The main object of the Union was to take practical steps towards advancing the welfare of sea-going engineers, and several matters affecting their interests had been discussed by the general council and brought under the notice of the Board of Trade. Among the proposals about to be considered by the council were: —1. That all steamers, whether cargo or passenger, should be surveyed by the Board of Trade. 2. That the N.H.P. of all steamers in the United Kingdom be fixed after measurement by the Board of Trade. 3. That every steamer (exclusive of tug steamers), no matter what her size, should be in charge of a certificated engineer. 4. That no one be permitted to take charge of the watch of any steamer unless he possesses an engineer's certificate. 5. That no one be allowed to take charge of a steam boiler unless he possesses an engineer's certificate or a boiler tender's license. It was also intended making arrangements for the practical education of young engineers, who, after passing an examination, would be granted diplomas, the same as was customary in the legal and other professions. Mr. Leask further detailed various additional reforms contemplated by the general council, and was at the close cordially thanked for his address. A new branch, to be known as "The Glasgow Branch of the Marine Engineers' Union," was duly constituted and office bearers appointed, Mr. John McDonald, hon. sec. The meeting was of a fairly representative character, and much interest was evinced in the proceedings.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 1st to 24th, 1887:—

[illegible], Wm. J., engineer to the *Trafalgar*, to date September 19th.
Chapman, W. P., assistant engineer to the *Buzzard*, to date September 12th.
[illegible], Alfred E. C., assistant engineer to the *Conqueror*, to date September 3rd.
[illegible], John M., engineer to the *Polyphemus*, to date September 1st.
[illegible], Wm. P., assistant engineer to the *Serapis*, to date September 12th.
Edmonds, Jas. C., engineer to the *Indus*, additional as assistant Admiralty overseer at the works of Lord Armstrong & Co., to date September 6th.
Egan, Oscar G., chief engineer to the *Ranger*, to date September 14th.
Fedarb, Wm., engineer to the *Severn*, to date September 3rd.
Gaisford, Harold, assistant engineer to the *Polyphemus*, to date September 1st.
Godbeer, Samuel, assistant engineer to the *Crocodile*, to date September 1st.
Griffin, Daniel, engineer to the *Asia*, additional, to date September 3rd.
Hawkins, Frank W., engineer to the *Aurora*, to date September 19th.
Hawkins, Hugh, engineer to the *Edinburgh*, to date September 14th.
Howlett, Wm. A., chief engineer to the *Turquoise*, to date September 14th.
Kerswell, George T., assistant engineer to the *Ajax*, to date September 14th.
Lane, Henry, engineer to the *Terror*, additional, to date September 13th.
Ludlow, G. T. J., engineer to the *Polyphemus*, to date September 1st.
Main, Frank, assistant engineer to the *Crocodile*, to date September 1st.
Miller, J., fleet engineer, to the *Hotspur*, to date September 24th.
May, Walter, assistant engineer to the *Polyphemus*, to date September 1st.
Parsons, W. G., engineer to the *Asia* as supernumerary, to date September 3rd.
Pleming, John W. engineer to the *Turquoise*, to date September 14th.
Reynolds, T. R., engineer to the *Alexandra*, additional, to date September 3rd.
Rutter, Edward J., assistant engineer to the *Humber*, to date September 21st.
Shirwell, James, engineer to the *Ranger* when recommissioned, until then additional, to date September 16th.
Toman, Richard W., assistant engineer to the *Hotspur*, additional, to date September 13th.
Tricker, E., staff engineer to the *Iris*, to date September 24th.
Trubshaw, R. H., fleet engineer to the *President*, additional for temporary service at the Admiralty, to date September 24th.
Vogwell, Charles A., staff engineer to the *Polyphemus*, to date September 1st.
Wise, F., engineer to the *Firefly*, to date September 24th.

SOUTH WALES TRADE NOTES.

Cardiff.—The shipments of steam coal from Cardiff during the past month have hardly reached the average. Prices of coal have a downward tendency. During the past few days quotations all round are lower and best qualities have experienced a drop of 1s. per ton. Good dry coal, except special brands, are now obtainable from 8s. 3d. to 8s. 6d. Monmouthshire coals have also depreciated in value to a like extent. In consequence of the depression which has prevailed for a considerable time in the fuel trade, there is little or no demand for small steam, and as a result this commodity is now on offer for 3s. 6d. a ton, and even less has been accepted. This quotation is 6d. per ton less than the price obtained during the depression that prevailed at the commencement of the year. The pitwood market is exceptionally firm, and good wood finds a ready sale at 15s. This, of course, is due to the fact that colliery proprietors are now laying in their stock for winter use. Welsh cokes are still in good demand at the quotations which have ruled this market for several weeks past. In the manufacturing iron and steel trades considerable activity prevails. All the local works are in full swing, and prices have an upward tendency. The Bilbao home rates, in consequence of the demand for ore, are firm, and for forward boats are steadily advancing. Carthagina home rates are steady, but there is no change in Hudson freights. The Bute Dock authorities deserve to be credited with a smart bit of work in their Bute East Dock. It appears that on the 9th September the German full-rigged ship *Elida*, 1,277 tons nett register, took fire under one of the tips near the bottom of the dock. A few hours after the outbreak it was found necessary to scuttle her before the fire could be extinguished. Two days after-

wards, as the ship was blocking the traffic, it was resolved to remove the wreck. For this purpose the powerful salvage steamer *Earl*, recently purchased by the Bute Docks Company, was requisitioned, and under the personal supervision of Captain Osborne, the deputy dock master, the water was pumped out of the vessel, and she was towed up to the top of the dock and placed under the shear legs within four hours. The following description of the *Earl* will no doubt be of interest. The *Earl* is an iron twin screw tug and salvage steamer, and was built to the order of Sir Wm. T. Lewis, the manager of the Bute Dock Estate, by Messrs. Edward Finch & Co., Limited, Shepstow. The vessel is fitted with a large centrifugal marine salvage pump, capable of discharging from 2,800 to 3,000 gallons per minute on a lift of 27 feet, drawing through five 6-inch bore suction pipes leading away from the vessel to any place within the range of suction that it may be desired to clear of water. The suctions are made operative simultaneously, or otherwise as required, by means of Finch & Co.'s improved quintuple sluice suction chest, secured to the central intake of the pump, which is also fitted with an improved self-acting seal valve on its discharge. The salvage outfit is of an extensive description, consisting of steel galvanized pipes and bends, flexible rubber hose with steel nozzles, retention valves, etc., the whole having fastenings of the most approved description for the successful execution of salvage operations under all conceivable conditions. The *Earl* has a mean steaming speed of 13½ knots per hour against tide, the engines developing 514 I.H.P. Her fire pump, one of the largest and most powerful extant, can throw a column of water to a vertical height of 122 feet. The combined pumping power of the two pumps for salvage work is about 275,000 gallons per hour, and without question the vessel is a most valuable acquisition to the port of Cardiff, apart from its services as a fire-boat and tug. It very seldom happens that any of our ocean-going steamers carry such a bulky deck load as the *Mount Tabor*, of Glasgow, did when she sailed from the Roath Basin, Cardiff, on the 16th inst. The deck load consisted of four iron lighters, 47 ft. 6 in. × 12 ft. × 5 ft. 6 in., with a carrying capacity of about 50 tons each. The lighters were constructed by the Penarth Shipbuilding and Ship Repairing Co., Limited, at Penarth, who only received the order about three weeks ago for the Italian Government for their Colliery Depôt at Massowah.

The new screw steamer *Casterton* left Penarth on Friday, the 23rd inst., with her first cargo of coal for Genoa. This vessel is constructed entirely of steel, by the Messrs. Irvine & Co., West Hartlepool, and engined by the Messrs. Blair & Co., Limited, Stockton, on the triple-expansion principle, 23½, 35½, and 58½ in., with 39 in. stroke, with an I.H.P. of 1,050. The vessel has a carrying capacity of 3,450 tons on a mean draught of 20 ft. 6 in. Her consumption of Welsh coal is 10 tons per day, with an average speed of 11 knots. With such results the ship ought to be a good paying investment. The steamer is under the command of Capt. Holbeck. Messrs. Robert Irvine & Co., of West Hartlepool, are the owners.

Newport.—It is gratifying to note that there has been a marked improvement in the coal shipments during the month. Steam freights are firm, and there is no weakness in quotation. Tin-plates are firm. There has been a considerable falling off in imports during the past few weeks. Prices for Bilbao ore range from 12s. 3d. to 12s. 6d. There has been a falling off in pitwood. Arrivals, and consequently prices, have advanced, the present rates being 15s. 6d. to 15s. 9d.

Swansea.—During the first half of the past month business at the docks has been dull, but during the week following the arrivals of tonnage were over the average, in fact, trade has been brisk all round. Rubio ore has been advanced to 12s. 6d. per ton, and the latest quotations for spelter are from £15 15s. to £15 17s. 6d. The latest tin-plate prices are:—Cokes, 13s. to 13s. 3d. I.C.; Bessemer steels, 13s. 3d. to 13s. 6d.; Siemens' steels, 13s. 9d. to 14s. (coke finish); best charcoals, 15s. 6d. to 18s. 6d.

A Kendal paper publishes a statement to the effect that the Barrow shipbuilding yard will shortly be taken over by an influential company, with the Marquis of Hartington at its head.

The Yachts Thistle and Volunteer.—The following are the principal dimensions of the vessels: *Thistle*, loadwater length. 86·4 ft.; beam, 20·3 ft.; draught of water, 12 ft. 6 in. *Volunteer*, loadwater length 85 ft. 9 in.; beam, 23 ft. 2 in.; draught of water, 10 ft., with a centre-board down 19 ft 6 in. The lines of the yacht *Thistle*, since she has been docked at New York excite great attention and admiration.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE unusually large output of shipping on the Clyde for August has not been followed up by any such activity during September, nor, on the other hand, has there been any decided improvement in the matter of orders received or in prospect. The total output for September amounts to something like 20,000 tons, 12,000 of which was launched in one week in the early part of the month. The most notable launch of the month was the large North German Lloyd steamer *Lahn* from the stocks of the Fairfield Company at Govan. The reduction this makes in the amount of tonnage on the Fairfield stocks is of course very considerable. Messrs. Napier & Son have not received any additional orders, and they continue to concentrate their efforts on the new steamer, which is ready for launching, for Messrs. Geo. Thompson and Co., of Aberdeen and London. The *Galatea* is laid up in the Queen's Dock awaiting the repairs on her engines necessitated by the late accident at her speed trials. The London and Glasgow Shipbuilding Company adjoining have received no further orders since that for two Japanese steamers, work on which is proceeding at a leisurely pace. Messrs. A. & J. Inglis are fairly well off for work, but their largest item is a magnificent steel steamer which they are constructing at their own risk, with a view to affording employment to their regular workmen. The other work on hand is a 2,000 ton steamer for a Tasmanian Company, and one of the same tonnage for the British India Steam Navigation Company. This latter vessel, it may be stated, is the 300th vessel built by Messrs. Inglis since starting business as shipbuilders, and it is understood that special prominence will be attached to the launching ceremony which will probably take place early in November. Messrs. Inglis, in common with other important firms, have recently been tendering for the construction of a large steamer of over 6,000 tons, and 460 ft. in length, for a company plying between Hamburgh and America. It is to be hoped the order will soon be placed with one or other of the firms tendering.

Messrs. D. & W. Henderson during the month launched the screw steamer *Rosarian*, of 3,000 tons, for the Allan line, and have on the stocks a sister ship to be launched shortly and named the *Monte Videan*. The dimensions of these vessels are:—Length, 330 ft.; breadth, 41 ft. 9 in.; and depth, 28 ft. 3 in. They are built of mild steel manufactured by the Siemens-Martin process, and are designed to combine easy propulsion with great carrying capacity on a light draught of water. They are built to the highest class at Lloyd's, and the butts and straps are arranged on a principle devised by Mr. Mumford, Lloyd's Head Surveyor in the Glasgow district, by which the rigidity of the attachment is much enhanced. These two vessels, with the two Monarch liners recently purchased by the Messrs. Allan, make an addition to their fleet of 15,000 tons.

At Linthouse shipyard, Messrs. A. Stephen & Sons are beginning to feel the want of work, though matters with them have been more satisfactory in this respect than with most other Clyde firms for many months. They have launched no fewer than four vessels lately in almost as many weeks.

In the Whiteinch district, where there are four shipbuilding yards (irrespective of Messrs. Thos. Wingate & Co., and W. B. Thompson and Co.'s yards, which are both closed) there are only two vessels on the stocks. The well-known firm of Barclay, Curle and Co. have nothing whatever on hand, a circumstance—like that connected with Messrs. McMillan, of Dumbarton—which is unprecedented in the history of the firm. For their engineering works at Finnieston, however, Messrs. Barclay, Curle and Co. have secured the order to fit out one of Messrs. Donaldson Brothers' steamers with triple-expansion engines in place of the present surface-condensing double-expansion type. Other steamers of the same line are likely to be converted to the new and approved system.

Messrs. William Simons & Co., of Renfrew, launched during the month the hopper dredger *Kuphus*, one of the largest and most complete of its kind yet constructed. The dredger, which is for the Bombay Port Trust, to be employed in deepening the port of Bombay, is 222 ft. in length, 40 ft. broad, and 15 ft. deep. The hopper which is in the centre can carry as much as 1,000 tons of spoil. Messrs. Lobnitz & Co. have turned out several other hopper barges for the Suez Canal Company, and continue to have work of this kind on hand.

Messrs. J. & G. Thomson, of Clydebank, are working assiduously at the two large Inman liners, and have completed the Spanish cruiser *Reina Regenté*, with which one or two preliminary trials have been run. The strike of riveters in Messrs. Thomson's yard, which had lasted over a month, was brought to a termination about the beginning of the month. The matter in dispute, as has already been stated, was the use of rivets heated by furnaces recently introduced, the men objecting to use them unless paid a substantial extra. The arrangement come to is that one of the decks of a steamer is to be finished with furnace-heated rivets by the apprentices, and all other riveting to be done by the riveters with rivets heated by the ordinary fires at the rate of 11s. 4d. per 100 rivets, as compared with 11s., less 13 per cent., which they received previously.

No new orders have been received by the shipbuilders or engineers of Dumbarton, and matters are in a worse condition there than they have been for many years. Messrs. A. McMillan and Son's yard remains closed, Messrs. Birrell & Stenhouse have despatched their last vessel and discharged all their workmen, while Messrs. Murray Bros., in their small yard, have only one craft on the stocks. The steam yacht *Thetis*, which they launched at the end of July for Mr. Donaldson, of London, is now completed. Messrs. Denny Bros. are the only firm having any work to speak of on hand, mainly consisting of light draught paddle steamers and flats for shipment abroad. The large steel steamer *Jelunga* they launched last month, is now in their wet dock receiving her machinery. Her engines, which are of the quadruple-expansion type, patented by Mr. W. Brock, managing partner of Messrs. Denny & Co., Dumbarton Engine Works, as seen in the erecting shop, are a magnificent example of Clyde workmanship. Messrs. Hardie and Gordon, of the Levenbank Foundry, are presently laying down plant in their works for the manufacture of steel on the open hearth process.

At Greenock the look out in connection with shipbuilding and engineering is dismal, although before the winter sets in it is anticipated one or two good orders will be received. Messrs. Caird & Co. have at present nothing on the stocks, and no orders in hand. About 350 workmen have been discharged by this firm within the last month, and further reductions are expected when the new P. & O. steamer *Britannia* is completely fitted out, which work represents the whole of this firm's engagements at present.

Messrs. Russell & Co., of Greenock and Port Glasgow, are rapidly getting through the work they have on hand—two steamers and two sailing ships. They have recently purchased the large iron sailing ship *Brambletye*, which was about four months ago wrecked in the North Sea, but was raised again after three months' submersion. The swelling of her grain cargo while under water burst open her decks and otherwise damaged her severely. Messrs. Russell will dock and repair her and put her into thoroughly good order.

Messrs. R. Duncan & Co. and Messrs. John Reid & Co. are the only other Port Glasgow firms whose yards seem to have demands upon them for new work, but neither Messrs. Duncan and Co., nor any of the others are working at one-half their capacity.

A considerable number of the Clyde shipbuilding firms have exhibits at the International Maritime Exhibition recently opened at Havre, and the following have received awards from the committee of adjudication:—The Fairfield Shipbuilding and Engineering Company, a Diploma of Honour; Messrs. W. Denny and Bros., Dumbarton, Messrs. A. and J. Inglis, Pointhouse, Glasgow, Messrs. Lobnitz and Co., Renfrew, and Messrs. Scott and Co., Greenock, Diplomas of Gold Medals; while a Diploma of Silver Medal has been given to Messrs. Simons & Co., of Renfrew.

Shipbuilding establishments on the east coast have been unusually active during the month in the matter of launches. About the beginning of the month Messrs. Pearce Bros., of Craigie Yard, Dundee, launched a notable vessel in the s.s. *Pollux*, designed and constructed for the special and increasingly important trade of petroleum carrying in bulk. She is for a Dundee owner, and her intended service is the carrying of petroleum oil or kerosene from Batoum, on the Black Sea, to the markets of western Europe, or from the American wells of Pennsylvania. Messrs. W. B. Thompson & Co., Limited, of Caledon Yard, Dundee, launched about the middle of the month the *Portland*, a splendidly equipped screw steamer, for the Clyde Shipping Company's fleet, for which they have previously built the s.s. *Eddystone*. Messrs. Thompson & Co. have just been awarded a gold medal by the jury of the Havre Maritime Exhibition for the models of a four-masted water ballast sailing ship and of a steam trawler. One vessel has been launched during the month from the yard of Messrs. Hall, Russell & Co., Aberdeen, and one from the Grangemouth Shipbuilding Company's Works at Grangemouth, so that matters on the east coast have been somewhat brisk. Unfortunately, however, there is the same scarcity of fresh orders as obtains in the west. Few of the yards have more than one or perhaps two vessels on the stocks or in prospect. The Dundee Loch Line Steamship Company, in place of patronising local firms, have just ordered a steamer of 4,150 tons deadweight capacity from the Palmer Shipbuilding Company, of Newcastle. The price, it is stated, amounts to slightly under £28,000, or about £6 15s. per ton of deadweight capacity. Messrs. John Scott & Co., of Kirkcaldy, have contracted with the General Steam Navigation Company, London, to build two steel paddle passenger steamers for them. One of them is to be a duplicate of the *Halcyon*, lately finished by the same firm for the same company, and the other to be of the same type, but to be larger, and to have a speed of twenty miles per hour. These two new vessels like the *Halcyon*, which has proved very satisfactory, are to be employed in the Thames passenger service next season. A new lifeboat was launched at Montrose on the 17th September, intended for service around that part of the north-east coast of Scotland. The new boat, which is the gift of Lady Wood, of Bath, is 37 ft. long by 8 ft. beam, and is fitted with water ballast compartments and all the latest improvements. It was named the *Augusta*, and after the launch it was put through a series of crucial tests, all of which it stood satisfactorily.

The important Nautical Academy at Greenock, which has hitherto been maintained by the Town Council and Harbour Trust, has been transferred to Messrs. M. Walker & Sons, nautical instrument makers, of Glasgow, Greenock, and Liverpool, who have agreed to maintain and conduct the institution for the future. The same firm have also undertaken the working and maintenance of the Nautical Academy in Glasgow.

Big ships are seemingly not such objects of wonderment in the home of steamship building as in those other parts where the *Great Eastern*, as a show ship, has been a success. The visitors to the great ship lying off Greenock have not averaged more than 400 per day lately, whereas in Liverpool the average was quite ten times that amount. This state of matters has led the proprietor to cease making provision for the conveyance of visitors to the ship and for their entertainment while on board. She will be laid up for the winter in the Gareloch, and with the spring and the exhibition stir of next year, fate may deal less hardly with her.

The Glasgow Exhibition affairs are progressing most favourably. The buildings are now emerging from the skeleton stage and beginning to assume definite form and solidity. It is expected that the whole of the erections will be roofed in and watertight before the winter sets in. Deputations have been visiting Sheffield, Birmingham, and other towns, submitting the claims of the forthcoming exhibition to the towns and trades' councils of these places, and promises of exhibits and other assistance have been willingly offered.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Though during the past few weeks a distinct improvement in the state of work in certain of the Tyne shipyards has been exhibited, it is to be regretted that a falling off of business has to be noted at other establishments. Messrs. Palmer have secured a large amount of work, and frame turning operations are now in full swing night and day. The same description applies to Messrs. Hawthorn & Leslie's yard, and as these are two of the largest concerns on the river, their prosperity is of course an important feature in the situation. They are, however, not the only yards that are provided with orders sufficient to tide them over the winter months. Messrs. Wood & Skinner's, Messrs. Dobson & Co.'s, and Messrs. Readhead's establishments, are all showing a goodly array of vessels upon their stocks, and in these instances there is every prospect of steady work being maintained into the early months of next year. It may be mentioned that two of the steamers on Messrs. Wood & Skinner's stocks have been ordered by a Russian company which has been formed for trading in the Black Sea. The company have ordered two other vessels from Messrs. Dobson & Co., and at both establishments every possible effort is being made to push on the work so as to ensure delivery by a stipulated date. Messrs. Swan & Hunter's

yard, which was quite busy all the year till now, has suddenly assumed a very bare appearance, no less than three vessels, representing an aggregate tonnage of about 10,000 tons, having been put off the stocks within the month. These vessels are all for colonial owners, and are supplied with electric light installations, and every modern improvement in the way of loading and discharging accessories. There is but one vessel left on the stocks, and this being unsold, is not at present being proceeded with. The fitting out of the vessels recently launched, however, will keep a good many hands engaged for some time to come, and there is little doubt that before the work on these boats is completed, some of the building berths that are now empty will again be tenanted. At Messrs. Schlesinger & Davis's yard, which adjoins Messrs. Swan & Hunter's, and at Messrs. Stephenson's, which is on the opposite side of the river, the work in hand is very limited, there being in each case but one vessel on the stocks. Besides those engaged in shipbuilding, however, at the former establishment, there is a strong force of hands employed in connection with the building of new boiler shops which are expected to be the largest and most elaborately fitted on the Tyne. The Tyne Shipbuilding Company have nothing on their stocks, excepting an unsold steamer, which is ready for launching, and upon which at present no work is being done. Messrs. Edwards, who after a long stoppage resumed operations last month, have still but one berth occupied, but it is understood that the firm have another order, and that a second keel will soon be laid. Messrs. W. Richardson & Co. have just launched a large vessel and have still a small one in progress. Two unsold vessels are still to be seen on the stocks of this establishment. The contracts in hand at Messrs. Armstrong & Mitchell's, Low Walker yard, are being rapidly finished up, but they are unfortunately not being replaced by others. The firm are engaged in making further important extensions, which will have the effect of considerably increasing their productive capacity. At their Elswick establishment no change is to be noted since last month. Several of the marine engineering establishments are now in very active work. The North Eastern Company, Wallsend, have orders sufficient to keep their place going briskly for at least six months, and the Slipway Engine Works at the same place are equally well secured against slackness for the next half year. Messrs. Palmer have several sets of exceptionally powerful triple-expansion engines in hand for the large vessels now on their stocks, and other works in the same line at Shields, Walker, and St. Peter's, are very fully employed. Messrs. Sprat & Morley, iron and steel founders, Hebburn, are doing a satisfactory business, but Messrs. Nicholson's boiler works at the same place are practically at a standstill. The last-named firm recently turned out two very superior finished boilers for a torpedo boat now being engined by Messrs. E. Scott and Co., Newcastle, but since then contracts have come in only slowly, and a temporary stoppage will probably be necessary. Messrs. Baird & Barnsley, of North Shields, though not particularly busy, are getting sufficient work to keep their machinery in steady operation. The engineering establishments in Newcastle and the vicinity, whose products mainly consist of steamship accessories, are generally keeping pretty steadily employed, while (except in the case of the North Eastern Railway shops) locomotive establishments are slack. Messrs. Smith, Patterson & Co., ironfounders, &c., Blaydon, have a heavy contract for castings to be used in the construction of the new tunnel now being made under the Thames. Messrs. Harfield & Co., of the same place, have an exceptionally large windlass in course of construction for a foreign war vessel. The same firm supplied a large windlass recently to the ironclad *Sans Pareil*. An extension of considerable importance is being made at the Newburn Steel Works. Messrs. Clark, Chapman & Parsons, Gateshead, are doing a fairly satisfactory trade in their steam winch windlass and steering gear department, but their electric light works are scarcely so busy as they were a little time ago. They are, however, putting installations in several first-class steamers, among others in the large vessel recently launched at Belfast for one of our leading transatlantic lines. Messrs. S. T. Taylor & Sons, Close, Newcastle, have obtained an order to cover the boilers, &c., of several first-class steamers that are to be engined by Messrs. Hawthorn, Leslie and Co. Messrs. Linkleter, of Tynemouth, have just completed a set of their patent accommodation ladders for one of the P. & O. Company's boats.

The Wear.—At the end of September the shipbuilding trade of the Wear seems to be in even a worse plight than at the end of August. Five vessels have been launched during the month, but in only one case has the vacated berth been occupied by another keel. This was at Messrs. Short Brothers' yard, the only establishment which is at present showing any approach to briskness. Of the five vessels launched, two were for English firms, and two for foreign or colonial owners, the fifth being the torpedo boat built by Messrs. Doxford on the speculative principle. Only one order is known to have come to the river during the month, and that was secured by Messrs. J. L. Thompson & Sons. Messrs. Doxford, however, are laying down a vessel, but it is understood that the order was obtained some time ago. At the Deptford yard a vessel is being commenced on the builder's own account, and the same thing is being done at two other establishments. In these three instances there is no other work in progress. Messrs. R. Thompson & Sons continue to do a steady business in repair work, but their yard at Southwick is temporarily closed. There are half-a-dozen other closed yards on the river, and in two instances the machinery has been sold off and removed. The marine engineering industry may fortunately be spoken of in more hopeful terms. The Palmer's Hill Works are busier than they were a month ago, some good orders having recently been received. At Messrs. Clark's establishment, Southwick, there is a fair supply of work, and the North-Eastern Engineering Company are able to keep the greater part of their machinery going. Messrs. Carr & Co.'s engine works, which were closed a few weeks ago, are advertised for sale. Considering the very slack state of shipbuilding, Messrs. John Lynn & Co. continue to have a satisfactory demand for their steam winches, steering gears, &c., and Mr. Calvert's foundry in the same neighbourhood is kept pretty busy on castings for that description of work and other deck accessories. Messrs. Irving & Jopling's boiler and tank works are actively employed just now, the firm being well provided with orders for both classes of work. The engine works at Bedford Street and Low Quay, of Messrs. C. & M. Douglas, are doing a moderate business, and the Bloomfield Engine Works, Monkwearmouth, are kept steadily employed with the manufacture of various specialities. The demand for Messrs. Bell & Rockliff's patent bulwark rails, hatch cleats, &c., is rapidly increasing, and Messrs. Tyzack's ironworks, where they are manufactured, are much better employed in consequence. The firm have orders for these articles from the Tyne, the Clyde, and other centres of shipbuilding.

The Tees.—Messrs. Raylton, Dixon & Co., have just secured an order for a large passenger steamer from a Liverpool firm, and their yard, which had become exceedingly slack, will soon again show signs of animation. With regard to the order referred to the competition was very keen, and it is a high testimony to the enterprise of the Middlesbro' firm that they secured it for their yard under such circumstances. It is stated that the firm have got another order, and the winter prospect at their establishment is now much improved. At each of the three Stockton yards business is comparatively good, and there are few resident workmen now out of employment. The pressure of work at Messrs. Blair & Co.'s engineering establishment is very great, and the boiler works of Messrs. Riley Brothers are showing a good state of business. Iron foundries both at Stockton and Middlesbro' continue to be well employed, and in the steel works, the brisk state of business that has existed for some time is fully maintained. In the finished iron trade operations continue to be conducted on an exceedingly limited scale, and in the pig iron industry the state of business has undergone little change for some weeks past, and may be correctly described as moderate.

The Hartlepools.—Messrs. Withey launched a large vessel towards the close of the month, and Messrs. W. Gray & Co. put one off the stocks at an earlier date. Orders for two steamers have been placed in the district within the past few days, one of them being of exceptionally large tonnage. There is a large amount of repair work in progress, and this circumstance tends to make up for the fact that a good many of the building berths are empty. The marine engineering establishments are still busy, and at the Central Marine Works an additional order has just been received.

Rolls for Boiler Plates.—Messrs. Campbell and Hunter have just completed the erection at Messrs. J. & G. Thomson's works, at Clydebank, of the largest set of rolls for boiler plates in this country. The rolls are vertical, and are capable of rolling steel plates 12 ft. wide and 1½ in. thick. The outer roll is so fitted, that it can be lifted up by a traveller crane, and so allowed of plates being rolled close. The rolls themselves are of forged steel, and are driven by a double cylinder Tangye engine of about 25 H.P.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Grasshopper.—On August 30th another addition was made to the Royal Navy by the launch at Sheerness Dockyard of the new twin-screw torpedo gun vessel *Grasshopper*, which has been built in No. 2 dock. The *Grasshopper* is a twin-screw steel torpedo gun vessel of a new type, and is a sister ship to the *Rattlesnake*. She was designed by Messrs. Barnes & Morgan, of the Royal Corps of Naval Constructors, and is 200 ft. in length and 23 ft. in breadth. Her draught of water forward is 6 ft. 6 in., and aft, 9 ft. 6 in., which is so light that it would enable her to attack torpedo vessels in comparatively shallow water, this being one of the chief purposes for which the *Grasshopper* has been designed. She has a displacement of 450 tons, and will be fitted with machinery of 3,000 H.P., which is estimated to propel her in a rough sea at 19 knots, or faster than torpedo boats can attain under similar conditions. The contract for her machinery has been entrusted to Messrs. Maudslay, Son & Field, and it is to be of the new triple-expansion type. She will have a coal-carrying capacity of 100 tons. The armament of the *Grasshopper* will consist of one 4-in. steel breech-loading gun, mounted on Vavasseur central pivot mountings in the fore part of the ship, and six 3-pounder quick-firing guns, two of which are to be placed forward, two aft, and two amidships. She is also fitted with three torpedo tubes for discharging 14 in. Whitehead torpedoes, and with a powerful electric light projector on a bridge abaft the 4 in. gun. The total cost of the *Grasshopper* is estimated at £35,968, made up as follows:—Cost of machinery, £13,168; fittings, mast, &c., £660; cost of hull, £17,740 (labour £13,925 and material £3,815); gun mountings, £875; torpedo gear, cost of armament, £1,903. Should the vessel be completed within her estimates, she will cost nearly £1,000 less than her sister ship, which was built by contract. Two more vessels of the *Grasshopper* type—the *Spider* and *Sandfly*—will be launched in a few weeks.

Murrumbidgee.—On September 1st Messrs. J. L. Thompson and Sons launched from their North Sands yard, on the Wear, a steel steamer. She is a sister ship to the *Hubbuck*, launched by them last year, and is of the same firm, Messrs. Lund, of London. Her dimensions are:—Length, 325 ft.; beam 40 ft.; and depth of hold, 26 ft. Her gross tonnage is about 2,800, and her I.H.P. 1,800. She is intended for the Australian wool trade. As the steamer left the ways she was named the *Murrumbidgee*. She will be engined by Messrs. Richardson, of Hartlepool; also fitted with a powerful direct acting windlass, Emerson, Walker & Co's patent, and Wasteneys Smith's patent stockless anchor stowing-up hawse pipe.

Courier.—On September 3rd there was launched from the shipbuilding yard of Messrs. C. S. Swan & Hunter, at Wallsend-on-Tyne, a screw steel excursion steamship for Messrs. Huddart, Parker & Co., of Melbourne and Sydney, intended to trade within the waters of Port Philip. The principal dimensions of the ship, which is the fourth built in this yard for the company, are:—Length between perpendiculars, 221 ft.; breadth, extreme, 30 ft.; depth, moulded, 14 ft. The vessel will be fitted with a drawing saloon 60 ft. long by the full breadth of the ship. Below this department is the dining saloon, 65 ft. long by the full width of the ship, and the tables have been so arranged that 200 persons can dine in comfort. Ample light is obtained in the dining room by large circular side ports, and ventilation is provided for by large tubes at both ends. Abreast of the engine room, on both sides, are fitted quarters for the captain, officers, and stewards. Under the topgallant forecastle is fitted a saloon for second cabin passengers, and in this cabin there is a ladies' cabin and a bar, with sitting accommodation, while the crew are comfortably housed under this deck. Provision is made for cooking for large numbers in a spacious galley next the engine-room. The promenade deck is 150 ft. long, of selected teak, the whole width of the ship, on which sitting accommodation is provided for some hundreds around the sides and in the centre of this deck, and the promenade has been so designed as to offer the least possible obstruction to passengers. A permanent awning covers the promenades. The Board of Trade will grant a certificate to carry about 2,000 passengers. The ship is divided into a large number of water-tight compartments, including water-tight bunkers, and has a number of tubular life rafts. The contract guaranteed speed of the ship on a severe trial of several hours' steaming at sea is 17 knots, and it is expected that a speed of 20 miles per hour will be accomplished, which gives 17·6 knots. In order to accomplish this result engines capable of indicating from 2,800 to 3,000 H.P. are being built by Messrs. R. and W. Hawthorn & Co., Limited, engineers, of St. Peter's. The engines are of the cruiser type, triple-expansion, being built of ample strength and lightness. Two steel boilers of extra large size are being provided, and in order to attain the highest result in speed and to save weight, forced draught will be applied. Messrs. Huddart, Parker, & Co., have also been desirous to secure for this ship an abnormally high rate of speed with natural draught, and the boilers have been so arranged as to secure a speed of 15½ to 16 knots without forcing. In order that the ship may be successfully manœuvred in narrow waters powerful steam steering gear is provided on deck, and a strong cast-steel sternpost with sluice openings is fitted, while in the engine-room steam reversing gear is applied. She has outfit of Wasteneys Smith's patent stockless anchors stowed up hawse pipes. The ship was named the *Courier* by Lady Berry, wife of Sir Graham Berry, Agent-General for Victoria, and formerly Premier of Victoria.

Hainaut.—On September 3rd the Barrow Shipbuilding Co. launched from their yard a fine sailing ship named the *Hainaut*, for Messrs. F. Speth & Co., of Antwerp. She is full ship rigged, and her dimensions are 240 ft. in length by 39 ft. beam by 23 ft. 8½ in. depth moulded. She is built entirely of steel, manufactured by the Barrow Hœmatite Steel Co. She has been built under the superintendence of Mr. A. G. Schaffer, of Newcastle-upon-Tyne, and the Bureau Veritas surveyors, Liverpool, and will receive the highest class in the Bureau Veritas register of shipping. Her tonnage is 1,750 tons gross, and will be capable of carrying 2,500 tons, and she is the first sailing ship built for carrying petroleum in bulk. The hold in which the petroleum is carried is divided into 10 separate compartments, and the ship has altogether 15 watertight compartments. The divisions are necessary for the safe carrying of petroleum in bulk, but this also adds to the safety of the ship, as it renders her practically unsinkable in the event of collision. The vessel is provided with three powerful pumps, two of them for loading and discharging petroleum and one for ballast purposes. Each pumping engine has two cylinders 7½ in. diameter and two pumps 7 in. diameter, the stroke being 10 in., and each engine capable of discharging 16,800 gallons per minute. The usual style and finish which characterizes the vessels turned out by the Barrow Co., has been fully maintained in this vessel, and she is a ship which will do credit both to owners and builders. The recent rapid development of the petroleum trade will, it is believed, lead to a large demand for vessels similar to the *Hainaut*, and it will probably not be long before the owners will be in a position to duplicate her. There was a large number of ladies and and gentlemen present to witness the launch, including Sir James Ramsden. As the vessel left the ways she was named the *Hainaut* by Mrs. E. A. Cohan, of Liverpool.

Henley.—On September 3rd Messrs. W. Gray & Co. launched from their yard a steel screw steamer of the following dimensions: length overall 292 ft., bredath 37 ft. 6 in., depth moulded 22 ft. 3 in., built to the order of Messrs. Watts, Ward & Co., London. This vessel is the fourth Messrs. W. Gray & Co. have built for Messrs. Watts, Ward & Co., and they have laid down another of larger dimensions for the same owners. The vessel just launched is sister ship to the *Hampstead*, which recently left for India on her first voyage. She takes Lloyd's highest class, and is of the improved well decked type, having the bridge extended forward of the main hatch. The poop aft contains handsome saloon accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore part of the bridge. Emerson Walker and Co.'s steam windlass is fitted forward with a capstan extending above the topgallant forecastle. The hull is built with web frames, giving strong sides, and dispensing with hold beams, thus avoiding any obstruction in the working of cargo. A cellular double bottom is fitted for water ballast throughout. Five hatches, two donkey boilers, four steam winches, and steam steering gear are fitted, and the ship is thoroughly equipped as a general trader. The engines, which are on the three cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co., Limited, Stockton-on-Tees. The vessel and machinery have been superintended during construction by Captain T. Hodgson and Mr. Alchin respectively, on behalf of the owners. The christening ceremony was gracefully performed by Miss Harriet Smith, of Seaton Carew, the vessel being named *Henley*.

Gem.—On September 3rd there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, a steel screw steamer of the following dimensions:—Length, 280 ft.; breadth 38 ft. 9 in.; depth, 19 ft. 6 in. The vessel has a full poop and quarter deck, bridge amidships extending to foremast, and topgallant forecastle; is built on the

cellular bottom principle for water ballast, and will be classed 100 A1, special survey at Lloyd's. The vessel will be fitted with triple-expansion engines, the cylinders having diameters respectively 21½ in., 36 in., and 59 in., with a stroke of 39 in., and will work at a pressure of 160 lbs. The engines are supplied with steam from two large steel boilers, the engines and boilers also being built by Messrs. Readhead & Co. The vessel has been built to the order of the Clapham Steamship Company (Limited), Newcastle-on-Tyne, and was named the *Gem* by Miss Nora M'Carthy, daughter of G. E. M'Carthy, Esq., managing director. The vessel has been built under the superintendence of Captain Wilson, and the machinery under the superintendence of Mr. William White, Newcastle-on-Tyne.

Prospero.—On September 3rd Messrs. W. H. Potter & Sons launched from their shipbuilding yard at the Queen's Dock, Liverpool, a steel-built screw steamer, for the South Wales and Liverpool Steamship Company, of which Messrs. R Gilchrist and Co., Liverpool, are the managers. The vessel, the construction of which was superintended by Mr. M'Cracken, engineer to the Company, is specially adapted for the tinplate trade, and is much in excess of Lloyd's requirements. She is fitted with water ballast tanks, and will possess special facilities for the rapid discharge of cargo, and a patent steam windlass by Emerson, Walker & Thompson Bros. The engines, which will be put on board by Messrs. David Rollo & Sons, will be on the triple-expansion principal, and of 500 H.P. With a full cargo the vessel will, it is expected, steam 10 knots per hour. Her length is 165ft., breadth 25 ft., and depth 12 ft. Her nett tonnage is 500 and gross 900. Miss Gleadell christened the ship the *Prospero*.

Hawk.—On September 15th there was launched from the yard of the Penarth Shipbuilding and Ship Repair Company, at Penarth Dock, a screw steamer of the following dimensions:—Length between perpendiculars, 70 ft.; beam, 15 ft.; and depth of hold, 8 ft. She has been constructed entirely of steel under special survey, and will be classed 100 A1 at Lloyd's. She will also carry passengers under Board of Trade certificate. She is ketch rigged, and is fitted with towing gear of a special design by Messrs. Watkins & Co., 121, Fenchurch Street, London, for which firm she has been built. The orthodox ceremony of christening the vessel was performed in a very graceful manner by Miss Lizzie Munroe, the daughter of the manager of the Penarth Shipbuilding Co. The young lady named the vessel *Hawk* as it left the ways amidst the cheers of the numerous spectators and employees of the yard. This makes the second vessel launched this year from the Penarth Shipbuilding Company's yard.

Bellona.—On September 17th the *Bellona* (s.) was launched at the shipbuilding yard of Messrs. C. S. Swan and Hunter, Wallsend. She is a steel screw steamer, built for the Deutsche Dampfschiffs Rhederei, of Hamburg, intended for the Japan and Eastern trade, and is of the following dimensions:—Length, 340 ft.; breadth, 38 ft. 3 in.; depth moulded, 26 ft. 3 in. The vessel is built on the three-deck grade, under special survey for the higher classification at Lloyd's, fitted with full poop, long bridge amidships, topgallant forecastle, iron decks, the upper deck being sheathed with teakwood, water ballast, four steam winches, direct steam windlass, steam steering gear. The main saloon will be fitted up for first-class passengers. The engines are of the triple-expansion surface-condensing type, built by Messrs. R. W. Hawthorn, Leslie and Co. (Limited), St. Peters, capable of indicating about 1,500 H.P. The *Bellona* was named by Mrs. Jos. Temperley, of Newcastle.

Eastern Prince.—On September 17th Messrs. Short Brothers launched from their shipbuilding yard at Pallion, Sunderland, a steel screw steamer, built to the order of the Prince Steam Shipping Company (Limited), Newcastle-on-Tyne. The principal dimensions are as follows:—Length, 292 ft.; breadth, 39 ft.; and depth moulded, 21 ft. 2 in. The vessel is built of Siemens-Martin steel to the highest class in Lloyd's registry, and is constructed on the web frame principle, thus dispensing with hold beams. She has a poop aft for the accommodation of captain and officers; there is a raised quarter-deck between the poop and bridge-house amidships, the latter being carried forward before the foremast, and in the front of this are the quarters for the crew, the forecastle being left open for deck shelter. The bottom is constructed on the cellular double bottom principle, and is divided into trimming tanks for water ballast. There are four large hatchways, with a powerful steam winch at each, a patent steam windlass by Messrs. Emerson Walker & Thompson Bros., London and Gateshead, and the vessel generally is fitted in the most approved manner for the rapid discharge of cargoes and quick despatch in loading. On leaving the ways the vessel was named *Eastern Prince*, the ceremony of christening being performed by Miss Nora Donald, daughter of Ald. Donald, of Shields. The vessel is to be fitted with triple-expansion engines by Mr. George Clark, of Southwick, with all the latest improvements in marine engineering.

Elvaston.—On September 17th there was launched from Mr. Laing's yard, at Sunderland, a vessel of about 3,000 tons burden, which has been built to the order of London owners. She is a sister ship to the *Cheniston*, launched some time ago, and was named the *Elvaston* on leaving the stocks. The engines, which are of the triple-expansion type, are to be supplied by Messrs. Clark & Co., Southwick, and the vessel has been moored beside the works of that firm.

Rosario.—On September 17th the passenger steamer *Rosario* was launched from the works of Messrs. Wigham Richardson and Co., the christening ceremony being performed by Miss Clark, of Croydon. The *Rosario* is the sixth steamer built at the Neptune Works for the owners, Messrs. Lavarello, of Genoa. She is expected to attain a speed of 14½ to 15 knots with natural draught, and to carry from 1,100 to 1,200 emigrants. Her dimensions are 300 ft. by 35 ft. by 27 ft. The engines are of the builders' own make, Tweedy's patent triplex, and will develop over 2,000 H.P.

Heathfield.—On September 19th Messrs. Edward Withy and Co., of West Hartlepool, launched the steel screw steamer *Heathfield*, built to the order of F. Wood Esq., of London. She is a vessel of 290 ft. in length, with a large deadweight carrying capacity and built to the 100 A1 class at Lloyd's. The vessel has a long raised quarter-deck, short poop, long bridge-house and a topgallant forecastle. The main, bridge, quarter and topgallant forecastle decks are of steel and iron, the charthouse, cabin skylight, engine room skylight, bulwarks, rails, galley, cargo battens and five watertight bulkheads of iron. The steamer is built on the frame system, and fitted with Withy & Livewright's patent improved cellular double bottom for water ballast all fore and aft; four steam winches, patent windlass, by Emerson, Walker, and Thomson Brothers, Limited, three stockless anchors hauling up into hawse pipes, steam quarter-master amidships, and right and left hand screw gear aft. The vessel is rigged as a two-masted fore aft schooner with iron lowermasts, and will be fitted with triple-expansion engines by the Central Marine Engineering Company, Limited, West Hartlepool. On leaving the ways she was gracefully christened *Heathfield* by Miss Vick.

LAUNCHES.—Scotch.

Helicon.—On August 30th Messrs. Charles Connell & Co. launched a finely modelled steel sailing ship, named the *Helicon*, a vessel of 1,600 tons register, and measuring 247 ft. by 38 ft. 6 in. by 23 ft. The vessel, which has been built for a Hamburg firm, will be supplied with gear and other appliances of the most improved description.

Hopper Barge.—On September 2nd Messrs. Lobnitz & Co., Renfrew, launched a twin-screw hopper barge of 400 tons measurement, and of the following dimensions:—Length, 135 ft.; beam, 25 ft.; depth, 11 ft. 6 in. The barge will be propelled by two independent pairs of compound engines, indicating collectively 300 H.P. The engines have also been supplied by the builders.

Hopper Dredger Kuphus.—On September 3rd there was launched from the shipbuilding-yard of Messrs. Wm. Simons and Co., of Renfrew, one of their patent hopper dredgers, constructed to the order of the Bombay Port Trust, and built from the designs revised by George E. Ormiston, Esq., C.E., engineer to the trust, to suit the requirements of the port and in connection with the extensive addition to the dock accommodation which the Port Trust have under construction. This vessel is of the following dimensions:—Length, 222 ft.; breadth, 40 ft.; depth, 15 ft.; and the hopper, which is situated near the centre of the vessel, is capable of containing 1,000 tons of dredged material. The bucket ladder is supported on a fore and aft horizontal framing, and is moved to project in advance of the dredger, and cut the vessel's own flotation or dredge to a depth of 35 ft. at the bottom of the quay wall if necessary, by means of the builder's patent traversing gear. The dredger is supplied with two sets of buckets, a large and a small set. The former are for dredging in free soil, and the latter, which are alternated with rippling claws, are used for dredging in hard material. They are made entirely of steel, and the large buckets will easily raise 500 tons per hour. The gearing is chiefly of steel. Surging wheels are fitted to prevent undue

strain on machinery when dredging hard ground. The upper and lower tumblers are of solid steel. Independent steam crab winches, with the barrels working independently or conjointly, are fitted at bow and stern of vessel. There are two pairs of compound surface-condensing engines of 1,100 I.H.P. collectively, and working independently of each other, one pair only being required for dredging; two steel boilers, with corrugated steel furnaces, having a working pressure of 95 lbs. per square inch; centrifugal pump, auxiliary engine for driving the hoisting gear, hopper door winches, steam steering gear, and turning lathes. The vessel was launched with the engines, boiler, and machinery in position, and nearly ready for work. The whole work has been carried out under the supervision of Mr. James A. M'Connachie, C.E., London, and Messrs. Dutton and Sanderson, Lloyd's surveyors; Mr. W. N. Bain, Glasgow, being resident inspector. The vessel as it left the ways was named the *Kuphus* by Mrs. J. A. M'Connachie.

Pollux.—On September 3rd there was launched from the yard of Messrs. Pearce Brothers, shipbuilders, Dundee, a steamer named the *Pollux*, built for Mr. W. S. Croudace, shipowner, Dundee, for carrying petroleum oil in bulk, and is the first steamer constructed specially for this purpose in Dundee. The *Pollux* will carry petroleum oil or kerosene from Batoum, on the Black Sea, to the markets of Western Europe, or from the American oil wells of Pennsylvania. The *Pollux* is 253 ft. long, 36 ft. broad, and 19 ft. 8 in. deep (moulded), and is constructed to carry 1,600 tons of oil. She has been built to class 100 A1 at Lloyd's, and is rigged as a two-masted schooner. The machinery is all carried aft, so as to be clear of the cargo—a most important provision in an oil-carrying steamer. She has been wholly constructed of Siemens-Martin steel plates. These have been made with lapped butts, and the rivets have been spaced one-fifth closer than required by Lloyd's, so as to give greater strength and tightness. The cargo space has been divided into 24 oil tanks and three overflow tanks, all the bulkheads being made with lapped butts and closer spacing, the same as in the hull, so that all are perfectly oil-tight. Special attention has been paid to the arrangements for filling and emptying the tanks, and also for their thorough ventilation to secure the safety of the vessel, and ensure quick dispatch in loading and discharging cargo. The ship is, through her numerous watertight compartments necessary for oil-carrying, practically unsinkable. To obviate all danger from naked lights, electric lighting has been adopted throughout the vessel. All lights on board, with the exception of the binnacle lights, will be from incandescent lamps. These are supplied in three circuits, viz., hold, engine-room, and saloon and signal lamps. The deck is also supplied with portable electric lamps. The vessel is fitted with a patent direct steam windlass, for rapid working of the anchors and cables, by Messrs. Emerson and Walker, of London and the Tyne, and an extra heavy outfit of anchors, chains, hawsers, and warps has been supplied. Four boats—two of them lifeboats—will be carried. The whole of the woodwork on board is very substantial, and the companions and skylights are of solid teak. Steam steering gear by Messrs. Alley and Maclellan, of Glasgow, has been fitted up. The regulation signal lights have been placed in towers at the break of the forecastle for convenience of attendance in heavy weather. The cabin is fitted up with accommodation for the captain and officers. Good accommodation is also provided for the engineers, while the forecastle is fitted up for the firemen and crew. The masts have been fitted with lightning conductors, owing to the inflammable nature of the cargo. A water-ballast tank is constructed aft for the purpose of trimming the vessel when light. The steamer is to be fitted with triple-expansion s.c. engines, also constructed by Messrs. Pearce Bros., of 900 I.H.P., with cylinders of 20 in., 30 in., and 50 in. by 36 in. stroke. The boilers can be worked to a pressure of 165 lbs. per cubic inch. The furnaces are fitted to burn either coal or liquid fuel, the latter a valuable adjunct to a steamer trading with a district where petroleum refuse is so cheap. A salient feature in the steamer has been the coating of the oil tanks with a petroleum-resisting composition, which has been discovered after careful experiments, and has been found thoroughly satisfactory. This has been a weak point in all previous petroleum bulk-carriers, for though many have delivered their first cargoes in good condition, the succeeding cargoes have been discoloured by rust to a greater or less degree according to the number of voyages made. The command of the *Pollux* has been entrusted to Captain W. Deuchars, who is well known in Dundee, having been for many years connected with the whaling trade, and who has also had experience in the Mediterranean and Black Sea trades.

Tug.—On September 5th the Abercorn Shipbuilding Company [launch]ed from their yard on the Cart a tug-steamer of about 80 tons, to be used for towing ships over the bar at Rio Grande do Sul. Her dimensions are 80 ft. long by 18 ft. 6 in. beam and 9 ft. 6 in. deep, and she is fitted with compound surface-condensing engines of 250 I.H.P., constructed by Messrs. Hanna, Donald & Wilson, engineers, Paisley.

Lahn.—On September 6th there was launched from the yard of the Fairfield Shipbuilding and Engineering Company (Limited) a steel screw steamer of about 5,500 tons gross register, for the Norddeutscher Lloyd Company, of Bremen. This vessel, which is intended for the company's Bremen and New York line, is of the following dimensions:—Length, 465 ft.; breadth, 49 ft.; depth, moulded, 36 ft. 6 in. She has been constructed in accordance with the newest regulations of the Germanischer Lloyd, and will be classed in the highest grade of that society. The upper and main decks are of teak, and all deck-houses, &c., are of steel and teak. To protect the vessel from the heavy Atlantic seas, strongly constructed turtle backs are placed at both ends of the ship. When completed, the vessel will have accommodation for 224 first-class, 106 second-class, and about 700 third-class passengers, besides ample accommodation for ship's officers and crew, 170 in number. The first-class passengers will be accommodated in the main deck, the dining saloon being forward of the engines and boilers. The second-class dining saloon is on the main deck aft. In the central part of the upper deck there is accommodation for officers, &c., also for galleys. Accommodation is found for the steerage passengers on the lower deck. Special attention has been paid to the ventilation. The outfit for the ship is complete with all the latest improvements, having steam windlass, steam and hand capstans, steam and hand steering gear, steam hold pumps, steam Downton pumps for fire and wash deck purposes, fresh water condenser, steel lifeboats, and Shepherd's collapsible lifeboats. The vessel is to be rigged with four pole masts of steel, with yards on the foremasts. This vessel will be fitted with triple-expansion engines. These engines have five inverted cylinders, with three cranks; two high pressure cylinders, each 32½ in. diameter; one intermediate pressure, 68 in. diameter; and two low pressure, each 85 in. diameter, and all adapted for a stroke of six feet. The valves are all arranged at the forward side of the cylinders, and will be worked by the usual double eccentrics and link motion. The reversing of the engines is effected by one of Messrs. Brown Bros.' steam and hydraulic reversing engines. The crank shaft is in three pieces, each of which is interchangeable with the other. The crank, tunnel, and propeller shafts are all made of Messrs. Vickers, Sons and Co.'s steel. The water for condensing the steam is circulated through the tubes of the condenser by two centrifugal pumps. These pumps can be used for pumping water out of the ship if required, in case of accidents. The propeller blades are cast of manganese bronze. Steam is supplied to the engines by six double-ended and one single-ended multitubular boilers, each fitted with Fox's patent corrugated furnaces. The total number of furnaces is 39. The boilers are constructed of steel, and adapted for a working pressure of 150 lbs. per square inch. The ceremony of naming the steamer the *Lahn* was performed by Mrs. Barnwell.

Musamah.—On September 6th Messrs. Lobnitz & Co. launched from their shipbuilding yard, at Renfrew, a twin-screw hopper barge for the Suez Canal Company. It is 400 tons in measurement, and in length it is 135 ft. and 25 ft. by 11 ft. 6 in. deep. The barge was named the *Musamah*. It will be propelled by two independent pair of compound engines, which will indicate collectively 300 H.P. The engines have also been constructed by the builders.

Mogul.—On September 7th there was launched from the shipbuilding yard of Messrs. Aitken and Mansel, Whiteinch, a steel screw vessel of about 2,800 tons gross register, named the *Mogul*, built to the order of Messrs. Gellatly, Hankey, Sewell & Co., of London, for their line of steamers trading between London and the East. This vessel is built to Lloyd's highest class, and also to meet Admiralty requirements, with passenger accommodation, partial double bottom, and all modern improvements to facilitate the working of cargo. The machinery, which is of the triple expansion type, and of 400 N.H.P, will be supplied by Messrs. John and James Thomson, Finnieston Engine Works. The *Mogul* received its name from Miss Thomson, of Kelvinside.

Oceana.—On September 7th there was launched from the yard of Messrs. Thomas Duncan & Co., at Port Glasgow, a four-masted steel ship of the following dimensions:—Length, 270 ft.; breadth, 40 ft.; depth of hold, 24 ft.; tonnage, 1,900 gross register. On leaving the ways she was named the *Oceana* by Miss Paterson,

eldest daughter of the owner, Mr. R. R. Paterson, Greenock. The *Oceana* is fitted with steam winches and donkey boiler, M'Conachy's patent ventilators and life-saving gangways and accommodation ladders, and Mills' patent pumps. The vessel has been superintended during construction by Mr. James M'Ewen, ship surveyor, Greenock, and will be commanded by Captain Page. After launching she was taken into Port Glasgow Harbour to receive masts and complete her outfit, afterwards proceeding to Glasgow to load pipes and coal for Bombay.

Rosarian.—On September 15th Messrs. D. & W. Henderson launched from their shipbuilding yard at Meadowside, Partick, the *Rosarian*, a steel screw steamer for Messrs. J. and A. Allan's fleet of Canadian, United States, and South American traders. The vessel, which has been specially constructed for the last mentioned part of the Allan Line service, is of the following dimensions:—Length, 330 ft.; breadth, 41 ft. 9 in.; and depth, 28 ft. 3 in., with a register of 3,000 tons, and a deadweight capacity of 4,300 tons. Her model is designed to combine easy propulsion with great carrying capacity and light draught of water. She has been built with water ballast arrangements of the most improved description. The *Rosarian* will be fitted with machinery of the triple expansion type, of 1,400 I.H.P., and having cylinders—high pressure 22½ in., intermediate 36 in., and low pressure 61 in. diameter, with a stroke of 48 in. Steam will be supplied from two double-ended boilers with a working pressure of 160 lbs. per square inch. Although intended principally for the cargo trade, the ship has accommodation for 20 first-class passengers, while 600 to 800 third-class passengers can also be berthed. The vessel will be fitted with all requisite gear and appliances of improved description. The christening ceremony was performed by Mrs. R. S. Allan.

Tabasqueno.—On September 15th the Grangemouth Dockyard Company launched from their yard at Grangemouth a screw-steamer named the *Tabasqueno*, of the following dimensions:—165 ft. long, 26 ft. beam, 10 ft. 6 in. depth to main deck, and 17 ft. 6 in. to shade deck. The ship is built of Siemens-Martin steel, and to Lloyd's 100 A1 class, under the special survey of their surveyor. She is to be handsomely fitted with large accommodation for first-class passengers, and special attention has been given to ventilation of the cabins, as this is an important point for vessels trading in hot climates. She will be fitted with all the latest improvements for working both the vessel and cargo, including Napier's patent windlass, Napier's screw-steering gear aft, and Messrs. Alley & M'Lellan's patent Sentinel steam-steering gear fitted in pilot house on bridge amidships, arranged to steer by both hand and steam from house and on top of flying bridge. The vessel is being supplied with a powerful set of compound surface-condensing engines by Messrs. Hutson and Corbett, of Kelvinhaugh Engine Works, Glasgow. The vessel is designed to carry a large cargo on an exceptionally light draught, and a good speed is expected. She is intended to trade on the coast of Mexico and the United States. The vessel has been built to the order of Messrs. M. Berreteaga & Co., of Seville, and Tabasco, Mexico, and will be commanded by Captain Urrechua, under whose superintendence she has been built. Mr. Andrew Carnegie, the American millionaire, and Mrs. Carnegie, attended the launch, which was witnessed by a large company. Preparatory to the launch taking place, Mrs. Carnegie presented to the builders a set of colours for the steamer, for which Mr. A. Spence returned thanks.

Portland.—On September 19th Messrs. W. B. Thompson and Co., Limited, Dundee, launched an iron screw steamer of above 1,000 tons, named the *Portland*, being the largest and latest addition to the fleet of the Clyde Shipping Company, of Glasgow. This is the second steamer built at the Caledon Shipyard for this company, the first being the s.s. *Eddystone*, launched last year, the *Portland* being a somewhat larger and more powerful vessel. Her principal dimensions are:—Length, 250 ft.; breadth, 38 ft. 6 in.; depth in hold, 16 ft. She has been built to the highest class at Lloyd's, and is intended for the company's London and Glasgow trade, which is becoming yearly more popular as a tourist route. There are five watertight bulkheads and three holds, with four steam cranes and two steam winches conveniently placed for the rapid handling of cargo. Steam for the crane and winches is supplied from a special boiler fired from the main deck. Water ballast is fitted under the afterhold and in the forepeak, to ensure a suitable trim for the vessel irrespective of the quantity and nature of the cargo carried. Steam steering gear, by Messrs. Muir and Caldwell, of Glasgow, is fitted in an iron wheelhouse at the front of the poop deck. The bulwarks, which are carried up to the same height as the poop and forecastle decks, are very substantially constructed, every frame being carried up the full height and further strengthened by closely-spaced dog-leg stanchions riveted to the deck and centre and top of bulwarks. Under the after end of the poop handsome and roomy accommodation is provided for 80 first-class passengers. The main entrance to the saloon is from an iron deck-house containing the smoking-room, saloon staircase, and a roomy state-room, all handsomely finished in polished teak. The centre portion of this house forms an upper saloon communicating with the lower saloon by a well, arranged after the style of the Atlantic mail boats, and will form a pleasant sitting-room in all weathers. The engines (constructed at Messrs. Thompson's Tay Foundry) are of the triple-expansion type, having cylinders 22½, 39 and 61 in. respectively, with a piston stroke of 48 in., each engine working on a separate crank. The crank shaft has three cranks, set at an angle of 120 degrees to each other. The low-pressure and intermediate cylinders are fitted with ordinary slide valves, the high-pressure having a piston valve, and all three valves are arranged for a variable cut-off. A separate circulating pump, wrought by Drysdale's centrifugal pump and engine combined, is provided for circulating the water through the condenser, and Weir's patent feed heater apparatus and automatic pumps are fitted. Steam is supplied by two multitubular boilers, constructed to Board of Trade and Lloyd's requirements for a working pressure of 156 lbs. per square inch, each boiler having three of Fox's patent corrugated flues. The mountings are all of the newest and most improved description for high pressure, and include Cockburn's patent safety valve and stop valve combined. The whole of the machinery and boilers are of a very strong design, and are throughout considerably in excess of Board of Trade and Lloyd's requirements.

Iron Screw Steamer.—On September 20th Samuel M'Knight and Co., Ayr Shipbuilding Yard, launched an iron screw steamer built to the order of Messrs. Clarke & Reeves, Great Yarmouth. The vessel is 145 ft. long by 22 ft. in breadth by 11 ft. in depth, and is of 300 tons gross register. She is fitted up with accommodation for first and second-class passengers, and will carry 300 tons cargo. She is intended to trade between Hull and Great Yarmouth.

Norfolk.—On September 20th S. M'Knight & Co. successfully launched from their shipbuilding yard, at Ayr, an iron screw-steamer named the *Norfolk*, for Messrs. Clarke & Reeves, steamship owners, Great Yarmouth, for their passenger service and general trade between Hull and Yarmouth. Her dimensions are:—Length, 145 ft.; breadth, 22 ft. 4 in.; depth of hold, 11 ft. 2 in.—300 tons gross register. She has a raised quarter-deck, with cabin under, which is fitted up in polished hardwood and neatly upholstered for the accommodation of 24 first-class passengers; long topgallant forecastle fitted up for 16 second-class passengers; engineers' and officers' rooms are under the bridge deck, while there is accommodation for the crew under forecastle deck. The vessel has opening gangways on both sides of bulwarks opposite each hatchway, and is fitted up with the most approved steam gear for rapid loading and discharging of cargo. The machinery, which will be supplied by William Kemp, engineer, Govan, is compound direct-acting surface-condensing, of 70 H.P. nominal. The hull and machinery have been constructed under Lloyd's and Board of Trade special survey, and the vessel will be furnished with their highest class certificate for passenger service. The construction of the steamer has been carried on under the superintendence of Mr. Snowden, the Company's engineer.

Oithona.—On September 21st a screw steamship named the *Oithona* was launched from the shipbuilding yard of Messrs. Hall, Russell & Co., Aberdeen. The vessel has been built to the order of the Aberdeen and London Steam Navigation Company, and will be employed in trading between Aberdeen and London. The gross tonnage is 750, and the engines are about 1,000 I.H.P.

LAUNCHES—Irish.

Derby Park.—On September 1st a steel sailing barque was launched by Messrs. Workman, Clark & Co. (Limited), from their shipyard at Spencer Basin, Belfast. This vessel has been built for Messrs. P. Iredale & Son, Liverpool. As the barque left the ways she was christened *Derby Park* by Mrs. John Porter, Carrickfergus. The dimensions of the vesse are:—Length, 241 ft.; breadth, 36 ft. 4in.; depth of hold, 21 ft. 5 in.; registered tonnage, 1,300; class at Lloyd's, 100 A1. She has a half-poop deck and topgallant forecastle. The crew are berthed in an iron house on the main deck forward, and the apprentices under the half-poop. The saloon, captain's, and officers' rooms,

bath, &c., are also fitted at the stern, under the poop deck. The masts, bowsprit, and principal yards are built of steel. The standing rigging is of steel wire and the running gear of flexible steel wire wherever practicable. The windlass is Emerson and Walker's patent, with a double-purchase capstan on the forecastle deck, and is driven by a messenger chain from the steam winch. The donkey boiler and steam winch are in an iron house at the main hatch; there are also powerful hand winches at the other hatches. Pumps are arranged to draw from both the centre and bilges of the ship, and are, like the deck fittings and work generally, of the best description.

Oceana.—On September 17th a steamship built for the Peninsular and Oriental Steam Navigation Company was launched from the yard of her builders, Messrs. Harland & Wolff, at Belfast. The ceremony of naming the vessel *Oceana* was performed by Miss Kendall, daughter of Mr. F. R. Kendall. The *Oceana* is 483 ft. long, 52 ft. beam, and 37 ft. deep, with a gross tonnage of about 6,500 tons. She is built of Siemens-Martin steel, and will have Lloyd's highest class. Her upper decks are of teak, and all her appliances, such as windlass, hydraulic lifts and winches, steam steering gear, &c., are of the most modern and approved description. She will be fitted up with triple-expansion engines of 6,000 I.H.P., also constructed by Messrs. Harland & Wolff. The *Oceana* being intended for passenger service between London and Australia, her cabins will be adapted for over 300 first and second-class passengers, and also a number of third-class. She will be on the Admiralty list and, if necessary, could be utilized as a fast cruiser or transport, in which last-named case she could accommodate nearly 4,000 troops. Electric light will be fitted throughout the ship, and, among other arrangements for promoting the comfort of passengers, there are refrigerating machinery and chambers for preserving fresh provisions, and mechanical ventilation.

LAUNCH.—German.

G. H. Wappaus.—On September 7th there was launched a sailing ship from the ways of the Flensburger Shipbuilding Co., to the order of Mr. A. H. Wappäus in Hamburg. She is built of English iron to Bureau Veritas and Lloyd's 100 A1, and will be cartrigged. As she started, she was named *G. H. Wappäus* by Miss Lilly Wappäus, the youngest daughter of Mr. A. H. Wappäus.

TRIAL TRIPS.

Elisabeth.—On August 20th the steam yacht *Elisabeth*, built for Captain Davies, of the River Dee Company, ran her trial trip. The *Elisabeth* is constructed of wood, 50 ft. long by 10 ft. 9 in. beam, and has a large cabin for passengers. The machinery, boiler, &c., were supplied by Messrs. Jensen & Co., of Perseverance Works, Birkenhead. The boiler is of the Admiralty type, and of Siemens' steel. The engines are Jensen's patent, 6 in. by 6 in. by 8 in., driving propeller 3 ft. 6 in. diameter by 5 ft. 6 in. pitch. The efficiency of the machinery exceeded the owner's anticipations, as the boat attained a speed of about twelve miles an hour.

Tasso.—On August 20th, the *Tasso*, built by Messrs. Russell and Co., at their Greenock building yard, for Messrs. Robert M'Andrew & Co., of London, for their South American trade, had an official trial of her machinery. The dimensions of the steamer are 320 ft. by 40 ft. by 27 ft. 6 in., and her gross tonnage 2,289. Her machinery, supplied by Messrs. James Howden & Co., Glasgow, consists of a set of triple-expansion engines, having cylinders respectively 23 in., 39 in., and 64 in. diameter, by 42 in. stroke, constructed on Howden's patent triple cylinder arrangement for engines working on three cranks, in which all waste heat from the high pressure valve casing is entirely prevented, and a free exhaust from the first to the second cylinder valve is attained without passages and without the friction and loss of heat arising therefrom, which is unavoidable in other arrangements. The low pressure valve is placed between the second and third cylinders, and the working steam in the casing is well preserved from loss of heat. The arrangements of the valves permit of triplicate crank shafts being used without the objectionable feature of the eccentricities being placed on the couplings. The engines of the *Tasso* are fitted with Dickinson's patent crank shaft. The steam is supplied at a pressure of 160 lbs. per square inch by two boilers, each 14 ft. 4 in. diameter, by 9 ft. 4½ in. long, worked on Howden's patent system of forced draught, having each three furnaces 3 ft. 3½ in. mean diameter. The area of fire grate in each boiler is 45 square feet, or 90 square feet in all. The *Tasso* left the James Watt Dock after 9 a.m. with the owner's representatives, Board of Trade and Lloyd's surveyors, and friends of the shipbuilders and engineers on board, and proceeded down Channel. After running for a time very satisfactorily with natural draught, the boilers were put under forced draught, with which steam was maintained at full boiler pressure for several hours with great ease, the fan running at a comparatively low speed and much under its normal power, while the engines were receiving all the steam they were capable of, using and developing 1,760 I.H.P. at 80 revolutions per minute. The speed of the vessel during this period taken on the mean of four continuous runs up and down on the measured mile at Skelmorlie was 13·131 knots per hour, a high speed for a vessel of the dimensions built on full lines for large cargo carrying. These results were both in speed and power much higher than expected by the owners of the vessel.

Her Majesty.—On August 25th the new steam trawler *Her Majesty*, built by Head and Riley, Groves' Shipyard, Hull, was tried under steam during a run of ten hours. The vessel left the Queen's Dock and proceeded to the St. Andrew's Dock, where a number of ladies and gentlemen were taken aboard, after which the vessel steamed to sea. The weather was all that could be desired. *Her Majesty* is a vessel constructed entirely for the steam trawling trade, and is fitted with all the latest improvements. The vessel's speed was registered by the log, and indicated a rate of 9½ knots, which was considered very satisfactory, the engine making 94 revolutions, which will be increased to 108.

Maranhao.—On September 1st the *Maranhao*, a screw steamer built by Messrs. James and George Thompson, shipbuilders and engineers, Clydebank, to the order of the Brazilian Steam Navigation Company, of Rio de Janeiro, for passenger trade between that place and the ports on the River Amazon, went down the Clyde on her trial cruise. The vessel, which is constructed of steel, is of the following dimensions:—Length, 276 ft.; breadth, 38 ft.; depth, 22 ft. 3½ in.; her tonnage being about 1,800 tons. She has been equipped as a first-class seagoing ship, and has obtained the highest class in Lloyd's register. Accommodation for about 100 first-class passengers is furnished in the main and lower decks abaft the engine-room. In the forward part of the vessel accommodation has been provided for 400 steerage passengers. The engines to propel the ship are of the triple-expansion type, and will indicate about 2,500 H.P. Steam is supplied by two large steel boilers. The vessel, which is rigged as a schooner, has been fitted with all modern appliances for discharging the cargo expeditiously and economically. The construction of the ship has been superintended, on behalf of the company, by Mr. Elijah Robinson, engineer of the Brazilian Company. The vessel was tried with all her load draft, and with all her weights on board, and the measured mile was run at the rate of 13¾ knots an hour. After the speed trial, a consumption trial of six hours was carried out, when it was shown that with a mean speed of 13·6 knots per hour the H.P. indicated with the Scotch coal in use was 1·39 lb, which is equivalent to about 1·2 lb. of Welsh coal. The trials both of speed and consumption were considered most satisfactory.

Edmond.—On September 2nd the trial trip of the steam hopper barge *Edmond* took place. The hull of the barge was built by Messrs. John Scott & Co., Kinghorn, and has been engined and fitted out by Messrs. George Anderson & Co., Arbroath Foundry. The craft is 105 ft. long, 23 ft. broad, and 9 ft. deep. Her engines are 180 I.H.P., and steam is supplied by a marine multitubular boiler with a working pressure of 90 lbs. per square inch. The *Edmond* is fitted with hydraulic machinery for emptying her hoppers, and has been constructed for service at the erection of a breakwater at Oporto, Portugal. The craft is the first of a pair of similar barges which have been contracted for by the Messrs. Anderson. The run extended over six miles, and all the machinery was found to work in a perfectly satisfactory manner.

Ethelburga.—On September 5th the new steel screw steamer *Ethelburga*, launched about four weeks previously, and built by Messrs. J. Readhead & Co., to the order of Messrs. Dillon, Horrawing and Co., London, was taken to sea on her trial trip. Her dimensions are:—290 ft. in length, 38½ ft. breadth, and 19 ft. 11 in. depth. She is classed 100 A1 at Lloyd's under special survey, and has a full poop, quarter-deck, and bridge amidships, extending to foremast and topgallant forecastle, and is built on the cellular bottom principle for water ballast. The vessel is very fully ven-

tilated, having 11 ventilators in holds alone, while engine room and stokehole are also exceptionally well provided in this respect. She is fitted with Pepper's patent combined steam and hand steering gear, manufactured by Messrs. J. Rogers & Co., Stockton, fitted in wheel house on bridge and also with connection to upper bridge; four steam winches (Clarke, Chapman & Parsons) with extra sized barrels to facilitate loading and discharging of cargoes with greater economy of fuel, donkey boiler being also of exceptionally large size. The engines, also built by Messrs. J. Readhead & Co., are of the triple-expansion type, on the three-crank principle, with cylinders having diameters 23 in., 37½ in. and 61½ in. and 39 in. stroke, with 160 lbs. pressure. The engines worked continuously during the trial without the slightest hitch at 82 revolutions, and were particularly noted for their great steadiness. The power developed by the engines being 1,347 I.H.P., and a vacuum of 27½ to 28 in. was maintained in the condenser. The engines are fitted with Messrs. Gray, Burnett & Co.'s automatic governor, and are supplied with steam by two extra large single-ended steel boilers measuring 14 ft. 4 in. in length, by 10 ft. diameter, and having a heating surface of 4,000 ft. There are six of Fox's corrugated furnaces, and with extremely easy firing the full pressure of 160 lbs. was easily maintained. Each boiler is also fitted with a hydro-kometer for circulating the water while getting up steam. The speed on the measured mile, after a series of runs, was ascertained to be 11¼ knots per hour. After the trial the vessel proceeded to Tyne dock to take her first cargo to Genoa. In addition to the Messrs. Readhead, there were present Mr. H. W. Dillon and Mr. J. H. Horrawing, the managing owners, Mr. R. Horrawing, Whitby, Mrs. J. H. Horrawing, Miss Horrawing, Mrs. H. I. Newton, Manor House, Penge, Captain Brockett, Captain George Willis, who takes command of the vessel, Mr. J. Walton, superintendent to Messrs. Dillon, Horrawing & Co., under whose supervision the vessel and engines were built, Mr. Menzies (of Menzies and Blagburn), Newcastle, consulting engineer, who inspected the engines during the trial trip on behalf of the owners. The toast, "Success to the *Ethelburga*," was proposed by Mr. J. Readhead, Sen., and responded to by Mr. Dillon and Mr. J. H. Horrawing; the health of the builders being proposed by Mr. R. Horrawing, Other toasts followed, and the greatest satisfaction was expressed by all the practical men present with the style and workmanship of the vessel and engines in every respect.

Rayo.—On September 7th the trial for speed of the new torpedo boat *Rayo*, built to the order of the Spanish Government, by Messrs. Thornycroft, of Chiswick, took place on the Thames. The *Rayo* is a sister boat to the *Ariete*, built for the Spanish Government some time since, and now in Spanish waters. She is of steel, contains twelve watertight compartments, and is a twin-screw vessel. She is constructed to carry four torpedoes, and is lighted by electricity. In addition to torpedoes, she will carry several machine guns, and is fitted with every modern appliance, in the way of condensers, steam pumps, and the like. The screws are worked by two pairs of compound surface-condensing engines, guaranteed to drive the boat at a speed of 24 knots per hour, the screw-propellers being hidden from sight by an over-hanging stern. The trial proved in every way successful, and the vessel attained a speed surpassing the contract requirements. Six runs were made over the measured mile, with the following results:—First run, against tide, 2·37¼ minutes; second, with tide, 2·10½ minutes; third, against tide, 2·36½ minutes; fourth, with tide, 2·9 minutes; fifth, against tide, 2·31½ minutes; sixth, with tide, 2·10¾ minutes; giving an average run of 29¼ statute miles per hour. The fastest run—the fourth—was equal to a speed of 32¼ statute miles. Subsequently a two hours' run past the Nore and to sea took place, a speed of 24·63 knots being recorded. The officers stated that this might have easily been increased to 25 knots.

Olga.—On September 8th the new twin-screw steamer *Olga*, just completed for the London and North Western Railway Company by Messrs. Laird Brothers, made her official trial trip at the mouth of the Mersey with satisfactory results. The speed, which was tested by several runs between the North-West lightship and the Bar Light, was close upon 16 knots, and the engines worked satisfactorily up to 100 revolutions, and 2,000 I.H.P. The *Olga* is intended for the Company's cattle trade between Holyhead and Dublin, and she proceeds at once for Holyhead to commence her service. Her dimensions are;—Length, 300 ft.; beam, 33 ft.; depth to main deck, 13 ft. 6 in. Tonnage (B.M.) 1,625, and she is fitted with two sets of direct-acting triple-expansion engines, with cylinders 19 in., 30 in., and 46½ in. diameter, and 36 in. stroke, and two double-ended steel boilers, working at 150 lbs. pressure. One feature specially noticed was the almost entire absence of vibration, due, no doubt, to the combined action of the twin screws and three cylinder triple-expansion engines.

Wybia.—On September 8th this screw steamer, which has been ordered by the Tasmanian Government on behalf of the Marine Board of Launceston, went on her trial trip. She is a steel vessel, 106 ft. by 20 ft. by 11 ft., classed 100 A1, but much in excess of Lloyd's requirements, and is suited for towing and passenger service. Her engines are compound surface-condensing 20 in. and 40 in. diameter by 26 in. stroke, with large double-furnace steel boiler, 100 lbs. working pressure. The equipment is very complete, including water ballast tanks, steam steering gear, steam windlass, steam starting gear, Murdoch's governor, Duncan's propeller, &c. On the trial trip a mean speed of 11·6 knots was attained. The contractors are Messrs. Ross and Duncan, Whitefield Works, Govan, and the hull department was executed for them by Messrs. Scott & Co., Bowling.

Roman Prince.—On September 9th the *Roman Prince* (s), which was launched a short time since from the yard of Messrs. Short Brothers, Sunderland, for Messrs. Knott and partners, Newcastle, went on her trial trip after adjusting compasses. A run was made north, when a mean speed of 11 knots was attained, the I.H.P. being about 980, on a consumption of about 12½ tons per day, which was considered satisfactory. The dimensions of the *Roman Prince* are as follows, viz:—Length, 290 ft.; breadth, 48 ft. 8 in.; and 18 ft. 9 in. depth. She is constructed of steel, to the highest class at Lloyd's Registry. The engines and boilers are by Mr. George Clark, of Southwick Engine Works.

Firefly.—On September 10th the twin screw steamer *Firefly*, which has been built for the Liverpool and New Ferry traffic, made her trial trip, and her behaviour was such as to indicate that she will prove an exceedingly successful boat in the service in which she is to be employed. The *Firefly* belongs to Mr. R. A. Macfie, and had been provided in consequence of the unsatisfactory nature of the ferry service between Liverpool and New Ferry. In October last, when Mr. Thompson gave up the service, Mr. Macfie decided to carry on the traffic himself, and with the assistance of Mr. J. Clarke, C.E., started a service of boats, calling at Rock Ferry. This arrangement was found to be unsatisfactory, it being felt that direct communication was necessary, and steamers were chartered to carry on the traffic. This plan was also unsuccessful, and Mr. Macfie decided to provide a new steamer, and place it on the passage. A number of well-known builders competed for the contract, which was secured by Mr. J. F. Waddington & Co., Seacombe. This firm has now provided Mr. Macfie with the *Firefly*, a vessel which, judging from her conduct on Saturday, does them great credit. She was specially designed by Mr. J. F. Waddington, and is the only vessel of the type on the Mersey. Her length is 138 ft., her breadth 18 ft., and her depth 9 ft. Her builders guaranteed a draught, with 300 passengers on board and 15 tons in bunker, of 5 ft. 6 in., but on Saturday her draught was 4 in. less than this. She is 106 tons net register and figure. She is expected to make an average speed of 12 knots an hour, making her one of the fastest ferry boats on the Mersey, and she is classed A1 at Lloyd's for channel purposes. The accommodation provided for passengers is of a most convenient description. She has a large deck saloon, with promenade deck above. She has also a commodious after cabin, with ladies' cabin and retiring-room, while forward there is an excellent smoking saloon. The cabins and saloons are fitted with steam heaters. The machinery of the vessel is of the most improved class, and was constructed and fitted by Messrs. David Rollo & Sons, of Fulton Engine Works, Liverpool, under the superintendance of Mr. Wm. Glover. It consists of two pairs of compound surface-condensing engines, having cylinders of 12½ in. and 25 in. diameter respectively, and a stroke of 18 in. Each engine has a set of air, feed, and bilge pumps, worked by links and lever from the L.P. crossheads, the circulating water being supplied by an independent centrifugal pumping engine. Steam of 100 lbs. working pressure is supplied by a large steel boiler, having three of Fox's patent corrugated furnaces.

Frigga.—On September 10th a new steel passenger steamer, built by the "Flensburger Schiffsbau Gesellschaft" at Flensburg, made her trial trip in the Flensburg Bay. This steamer is built to the order of the "Deutsche Dampfschifffahrt Gesellschaft" Kingsin Line, at Hamburg, and has following dimensions:—Length, 302 ft.; breadth, 36 ft. 6 in.; depth 23 ft. 2 in. She has highest class in Bureau Veritas, and Lloyd's 100 A1 three-deck

rule. Under the poop aft is placed a very elegant saloon, smoking-room and comfortable berths for 25 passengers. The triple-expansion engines, also built by the "Flensburger Schiffsbau Gesellschaft," worked to entire satisfaction. The vessel was full loaded with sand ballast and attained an average speed of 11½ knots.

Eagle.—On September 13th the new steamer *Eagle*, which was purchased from the trustees on the estate of Messrs. Blackwood and Gordon, Port Glasgow, by Mr. Hugh M'Intyre for an English firm, went down the river on her trial trip. She obtained a speed of 10 knots per hour, which was considered highly satisfactory by her owners. This vessel is intended for the cattle and passenger trade on the River Amazon. She has been taken into the Port Glasgow Graving Dock, where she will be inspected and fitted with a spar deck for the accommodation of cattle. The alterations will be very considerable, and will give much-needed employment to a large number of workmen in the town.

Tartar.—On September 14th this handsome steamer, which has been built by Messrs. Raylton, Dixon & Co., for the China tea trade, to the order of the Mogul S.S. Co. (Messrs. Gellatly, Hankey, Sewell & Co.), proceeded on her trial trip. Her leading dimensions are:—Length over all, 332 ft., breadth, 38 ft., depth, 27 ft. moulded. She is built on fine lines for the special trade in which she is engaged, and will carry a cargo of over 4,100 tons of tea. She has long bridge, topgallant forecastle, and poop aft, in which latter are placed handsome saloon, and accommodation for passengers. Her decks are of teak, and she is fitted with water ballast in after hold, and under the engine room. The great success of her sister ship, the *Ching Wo*, which was built by the same firm two years ago, has led to the adoption of the same type of engines, viz., on the triple-expansion principle by Messrs. Richardson & Sons, of Hartlepool, having Wyllie's patent valve gear. These engines developed 1,700 I.H.P., and worked with the greatest smoothness on the trial, giving a speed to the vessel of 12½ knots. She is commanded by Captain Bailey, under whose supervision she has been fitted out, and on completion of trial trip proceeded to Hamburg, where she will complete her loading for the China Seas.

Foyle.—On September 17th this steamer, recently launched by Mr. Charles J. Bigger, Londonderry, and engined by Messrs. Dunsmuir & Jackson, Govan, went down the river on her trial trip. She is fitted with a set of triple-expansion engines of the latest design, and working at a pressure of 150 lbs. per square inch. After adjusting compasses she ran the measured mile, attaining the speed of 11½ knots per hour. The machinery worked with great smoothness and regularity, and gave entire satisfaction.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

POSITION OF MARINE ENGINEERS.

To the Editor of The Marine Engineer.

Sir,—I do not know who wrote the letter in your last issue, signed "Little 99 P," but no matter, he possesses a thoroughly practical turn of mind. He goes straight to the point without unnecessary verbiage, and does not hesitate to speak out boldly where he considers grievances exist, and ought to be remedied or removed. The rating of N.H.P. as practised at present is a crying evil. It should be stopped at once, as your correspondent suggests, and the Executive of the Union, being of the same opinion, it has been decided that one of the items in their programme of reform shall be "That the N.H.P. of all steamers registered in the United Kingdom, after a certain date, shall be fixed by the Board of Trade after measurement by its surveyors." It may appear to your correspondent and others also that the Board of Trade aid and abet unscrupulous shipowners in carrying out this fraud; but such is not the case, for quite lately one of its officials called my attention to the case of two steamers rated as 98 and 99 H.P., and showed me his calculations, whereby they were proved to be in reality of 145 and 156 H.P. respectively! The remarks made by the said official regarding the owners of these crafts, for practising so glaring and barefaced an imposition, were such as would have done "Little 99 P" good to hear, and would have convinced him that the Board of Trade had no leaning towards such wrongdoers. The officials can only carry out the provisions of the law as laid down to them; they have no power to alter them. That must, and, I may say, *will* be done by Parliament, probably next session, through the action of the Union's executive, to whom the large steamship companies are in duty bound to give their support when a measure of that nature is introduced by them into the House.

Another of our items requires it to be enacted that no one shall be entrusted with a watch unless he has an engineer's certificate of some class, and in order to provide for junior engineers, as mentioned in my last letter, it is proposed to have a 3rd class certificate, which would meet all the requirements of the service. Your correspondent's proposal that a penalty should be inflicted upon any one who signs or acts as engineer without having the qualification, is warmly endorsed by the Union, who maintain that if it is just to punish quackery in the legal and medical professions, it must be equally just to punish it in the marine engineering, and they intend to try and bring this about in due course. If our friend, "Little 99 P," will kindly refer to my previous letters to you, from April to September inclusive, he will find that his other remarks have been already the subject of correspondence, and, I trust, were disposed of in such a way as to meet his approval. The term "Union," has already been freely discussed, and, I ventured to hope the question, as to its adoption, had been laid to rest for a time, but here it crops up again. It was necessity, not choice, that led to its use, but as there is now something in the wind which will eventually bring about a change for the better, both in the name and constitution of this association of marine engineers, I think we may safely leave its title alone for the present. It is only a matter of sentiment after all, not of fact, for the word, "Union," is *strictly correct* in its present application.

Every seaport has its independent local society (called a Branch), with whose management no one can interfere, and the bringing together of all these for concerted action in matters affecting the common good, constitutes what is known as the "Marine Engineers' Union." The constitution of the United States of America forms an excellent precedent, and their present strength and prosperity, an admirable example for us to follow.

I had the pleasure yesterday evening of taking a part in the formation of a Branch of the Union in Glasgow, which has been opened in response to a requisition, signed by some 30 certificated engineers, residing in or trading to and from the port, who were desirous of becoming members. There were already between thirty or forty members residing in the district, so that the two taken together will form a very respectable contingent to begin with. Our brethren there have been equally fortunate, with those at the branches previously opened, in securing a local hon. Secretary of the right sort, who has set about his new duties with all energy, and has to-day secured most eligible premises for Club Rooms at this address, which will be fitted up and opened without delay.

A petition has also been received from Sunderland, signed by more than twenty certificated engineers, requesting the Union to open a Branch there, which will have been accomplished before this appears in print, and the petition from another seaport is now being filled up, and is daily expected at headquarters. Our membership is steadily rising, and, at the present rate, a few more weeks will enable us to announce that we have enrolled the first thousand members. This is only about a twelfth part of the number who are eligible for, and ought to join the Union, but it must be admitted that we have made a very good start, and we have every confidence in being able to continue our progress with a like success.

Thanking you for past and present favours,

I remain, Yours, &c.,

THE HONORARY CHIEF SECRETARY,

Marine Engineers' Union.

45, Bridge Street, Glasgow,

22nd September, 1887.

[For want of space we are obliged to leave over some correspondence on "Position of Marine Engineers."—Ed. M.E.]

FORCED DRAUGHT.

To the Editor of THE MARINE ENGINEER.

SIR,—In your September number there is an article on "Forced Draught," evidently written for the purpose of extolling the merits of the closed stokehold system at the expense of all other modes of increasing the efficiency of fires. Though the article is anonymous, the source of its inspiration is not difficult to guess.

The writer indulges in some ill-natured remarks on my system in connection with its application to the boilers of the Inman steamer *Ohio*, which, he states, has given deficient results on her voyage across the Atlantic to those of the official trials, and not obscurely insinuating doubts as to the correctness of the published reports of these trials. The crude remarks of the writer of this article would not be worth noticing, but for the fact that a much larger proportion of readers accept and spread about prejudicial statements regarding things about which they are imperfectly informed, than those who receive kindly remarks of a favourable character.

Another reason for my noticing the remarks on my system in this article is that there are certain facts connected with the first voyage of the *Ohio* to America and back, which, to those not acquainted with the circumstances, might seem to justify the insinuations of the writer, though, doubtless, he is aware that they had no connection with the efficiency or non-efficiency of my system. I wish to show there are no grounds for his adverse comments. The facts are simply these: The fan driving gear, supplied by one of the most noted firms in the kingdom for such appliances, broke down time after time, and necessitated the working of the boilers on natural draught for several days on the voyage, the whole air for combustion in this steamer being supplied by one fan of 5 ft. 6 in. diameter.

Since the first voyage the fan driving gear has been made durable and efficient, and, in consequence, the *Ohio* performed her last run with a considerable increase on her official trial results as regards I.H.P., and on a consumption of small American coal but little above that of the official trial.

From the results now being obtained in the *Ohio*, it is evident that 22 I.H.P. per square foot of her fire grate of 112 square feet can be maintained without difficulty at sea with ordinary qualities of coal; this I.H.P. being considerably more than was obtained at the official trial, which was run under unfavourable conditions, and that the consumption will be quite as favourable at sea as on that trial.

The laudatory remarks of the writer of the article on the closed stokehold system are somewhat remarkable. He says this "the only plan that seems to hold its own." This rosy view of the case scarcely tallies with the fact, that though this system has been for many years before steamship owners and engineers eager to adopt any promising arrangement, especially when they can have it, as they can have this system, without charge, yet no one has ventured to use it in a mercantile steamer under ordinary conditions of working at sea, though they have all the examples of the many ships of the Navy to guide them.

The reasons for this singular abstention are, however, obvious. I have stated them at length in my papers on this subject. Our steamship owners and engineers are not altogether fools, and have not been all these years so blind to their own interests, as this writer would have us to believe. No steamer of our Navy, fitted with this system, has yet dared to try it continuously at sea, at full power, under ordinary working conditions.

The case of the *Ohio*, to which the writer has disparagingly referred, will afford a good illustration of the effects of the two systems. The main boilers of this steamer, in the voyages across the Atlantic already completed, have had to supply such a large proportion of steam for other purposes than propelling the ship, that a large quantity of salt water direct from the sea has been used to make up the waste, so that the boilers on each run have been worked so salt as to form a considerable scale on the plating. With my system of working, which entirely prevents the access of cold air to the furnace when the doors are opened, the boilers were worked at 150 lbs. pressure, and at a rate of combustion sufficient to fire from 20 to 22 I.H.P. from each square foot of grate without any danger. Had the closed stokehold system been used under the same conditions, the boilers would never have brought the ship across the Atlantic; they would have been utterly ruined before getting half way.

If one firm has had the temerity to adopt this closed stokehold system for an Atlantic passenger steamer, it will be quite time enough for this writer to extol its merits after it has been sufficiently and successfully tested at sea. I do not believe it likely that the laws of nature, in regard to this matter, will be suspended in favour of any firm, however eminent.

I am, yours faithfully,

JAMES HOWDEN.

"JOY'S" PATENT VALVE GEAR.

To the Editor of THE MARINE ENGINEER.

SIR,—Referring to the paragraph which appeared in your last month's issue, calling attention to the breakdowns that have taken place in H.M.S. *Narcissus*, *Amphion*, and *Galatea*, which are fitted with valve gear of Joy's and similar types, it would be interesting to know the exact causes of these failures, and it seems to us a pity that some authortative evidence should not be published as to the reasons why these valve gears broke down.

We may say that we have ourselves used "Joy's" valve gearing, with the greatest success, for the last six years, and during that time we have never heard of any mishap occurring to the valve gear of this type, which we have fitted. We have, however, never used either ordinary slide or piston valves in connection with the gear, but have always used Payton and Wilson's patent circular-balanced and double-ported slide valves, and we think in all probability these reported breakdowns of valve gear in H.M. ships, are caused not by any defect in the gear, but in the cumbrous piston and other valves, which have been fitted.

Our own experience of what the writer of the paragraph calls "*fancy notions for slide valves, as compared with the tried and never-failing link motion*," has been entirely in favour of the former, as they are quite as reliable in working, and give a decidedly better distribution of the stream, especially when working expansively. There are other minor advantages in the use of these gears, such as the shortening of the engine fore and aft, the absence of any keyways in the crank shaft, and the freedom to lengthen the main bearings without being interfered with by the valve gear; all of which renders them preferable to link motion.

We may add that as we have no interest in any of these particular gears, our only object in addressing you is to counteract the effect which your paragraph might have in deterring marine engineers from adopting a type of gear which has been so extensively adopted during the last four years, both by railway and marine engineers. We are, yours faithfully,

ALEX. WILSON & CO.

[We are pleased to be able to correct mis-information supplied to us as to the breakdown on the *Amphion* fitted with Joy's valve gear. The breakdown was not in the valve gear but in the air-pump, and the former seems to have worked admirably. We quite agree with the writer's suggestion that any gear, however good, may be overweighted by unsuitably designed valves, such as heavy piston valves which might be liable to jam.—ED. M.E.]

Review.

A Handbook of Dynamos, Lamps, and Apparatus for Electric Light and Transmission of Power. London and Halifax: Messrs. W. T. Goolden & Co.

WE have recently received a small handbook bearing the above title and being the fifth edition of Messrs. W. T. Goolden & Co.'s price list. In addition to the usual prices, particulars of weight, output, &c., of the different machines, fittings, apparatus, and instruments manufactured by this firm, the book contains some useful information on the subject of dynamos and electric lighting generally, the few pages given up to "Directions for working Dynamos" being specially prepared for the guidance of those in charge of installations; while to those contemplating the fitting up of electric light plant, the information given under the respective headings of "Lamps," "Cost of Running," and "Motive Power," will no doubt prove of special interest. Among the illustrations of the different types of dynamos made by the firm we notice the "A" or Admiralty type, the leading features of which are its compactness and the small floor space occupied, while the lowness of the shaft's centre renders it very suitable for coupling direct to high speed engines. This type of dynamo has been supplied by Messrs. W. T. Goolden & Co. to the British and Indian Governments for the following vessels, viz.: Her Majesty's ships *Mersey*, *Severn*, *Orlando*, and *Undaunted;* also 10 torpedo boats, and 3 sets now under construction for H.M.S. *Swiftsure* and *Solage*, and H. M. I. M. s.s. *Dalhousie* and *Lawrence*. In the case of the Indian steamers the entire installations, including

engines, dynamos, lamps, fittings, instruments, wires, casings, and switches were supplied and fitted by the firm, whose staff undertake all drilling through iron or steel decks and bulkheads, fitting water-tight glands, &c. Among other vessels fitted, or fitting by this firm, we may mention the following: H.M. ships *Devastation* and *Hero*.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from August 9th to September 19th, 1887.

10903 J. Waters. Floating anchors.
10905 H. Echberg. Channel torpedoes.
10908 S. Seccombe. Pumping apparatus.
10978 S. Bennett & R. G. Brooke. Valves or taps.
10981 J. H. Lamprey. Armour for ships.
11005 J. Brunn. Automatic lubricators.
11053 C. Henderson. Collapsible boats.
11062 Haddan (M. Lindner). Automatic feed lubricators.
11073 W. Alexander. Steering ships.
11089 G. E. Skliras. Wheel breakwater.
11093 Clark (J. & E. Vernaudon). Pneumatic dredgers.
11161 T. Clifford. Navigation of canals, rivers, &c.
11171 C. T. Porter. Piston valves and ports for steam engines.
11175 W. C. Martyn & D. B. Hutton. Spring metallic packing.
11225 T. Gilmour. Feeding heating apparatus for steam boilers.
11226 J. Howden. Triple-expansion engines.
11256 Newton (G. Allman). Ships' danger indicators.
11365 J. McKirdy. Saving life at sea.
11366 J. McKirdy. Ships' port-hole lights.
11385 T. A. Segrave. Screw propeller for ships.
11395 J. E. Clifford. Screw propeller shaft.
11400 J. W. Hobson. Raising wrecks or sunken vessels.
11405 M. Mitchell. Utilizing the rise and fall of the tide as motive power.
11406 R. J. Rae. Windlasses and capstans.
11443 J. W. Miller. Life saving raft.
11481 Johnson (D. D. MacMullen). Lubricators.
11517 H. W. Cook. Controlling steam engines by electricity.
11541 E. Griffon. Propulsion of ships.
11544 J. W. White. War vessels.
11559 W. O'Keefe. Rectifying mariners' compasses.
11560 Budenberg (Schäffer & Budenberg). Injectors.
11569 L. McIntyre. Ventilating stokeholes and boiler compartments of ships.
11571 R. E. Shill & A. Martin. Hardening and chilling the face of armour plates.
11575 W. Wilkie. Fire bar.
11617 J. F. Thompson. Steam engines.
11631 W. F. Bowen. Steam engine governor.
11632 A. Bradshaw. Expansive vessels of steam traps.
11636 R. Robson. Atmospheric injector for improving draught in furnace.
11639 W. E. Kochs. Loading and unloading vessels.
11650 T. C. Harris. Compound donkey pumps.
11656 J. Robinson. Steering gear.
11679 W. P. Strawson. Anchors.
11699 C. C. Barton. Valves.
11719 R. Fraser. Water circulating, feed heating and water purifying apparatus.
11736 F. J. Davies. Boat releasing apparatus.
11737 W. Welch. Fans for ships' ventilation and forced draught.
11778 Jensen (W. H. Bright). Rotary steam engines.
11789 Fairweather (The Babcock & Wilcox Co.). Sectional steam generators.
11818 J. R. Barrett. Travelling by water without the aid of oars.
11828 J. H. Laidman. Ships' rudders.
11834 A. Fehlen. Motor.
11838 H. C. Lobnitz. Valve gear for steam engines.
11870 H. O. Arnold Forster. Ships' coal bunkers.
11877 J. Nicholas & H. H. Fanshawe. Water or liquid gauges in boilers.
11892 L. C. Niebour. Lowering ships' boats.
11894 B. D. Healey. Working furnace rocking bars.
11915 Boult (J. T. Case). Motor engines.
11918 A. H. Williams. Life or swimming belt.
11919 A. H. Williams. Air tight cases for raft seats and other life saving apparatus.
11920 A. H. Williams. Raft seats.
11941 Thompson (G. C. Baker). Controlling and propelling boats.
11964 Heath (W. M. Walters). Ships' logs.
11994 R. W. Roberts. Preventing collision of steamers.
12060 S. Willington. Propulsion and steering of vessels.
12125 McLaren (A. R. MacKenzie). Marine engines.
12139 J. Chorlton & G. L. Scott. Ships' berths.
12169 P. Alfieri. Preventing and removing incrustation in steam boilers.
12200 W. Musgrave. Corliss valves for motive power engines.
12204 A. Vogt. Dredging apparatus.
12227 J. O. Spence. Applying oil to waves.
12232 G. Hartshorne & G. F. Simms. Anchors.
12246 H. L. Currier. Removing scale, &c., from boilers.
12254 D. Joy. Converting compound engines to triple-expansion engines.
12301 A. van Raalte. Steam pile drivers.
12303 L. Somzée. Preventing collisions at sea.
12315 W. R. Kinipple. Suction dredgers.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

August 20th, 1887.

Anderson, A. N.	1C	N.Shields
Francies, John ..	2C	Cardiff
Gregory, Geo. E.	2C	,,
Heard, George H.	1C	London
Kay, Joseph	1C	Cardiff
Lewis, Walter T.	2C	,,
McGregor, Alex..	2C	,,
Morgan, Lewis L.	2C	,,
Murray, Robert..	2C	Liverpool
Norris, Walter ..	2C	N.Shields
Owen, Robert ..	2C	Liverpool
Rea, George	2C	Hull
Rusden, Harry..	2C	N.Shields
Rutherford, T.W.W.	2C	,,
Ryder, Edw. H.	2C	London
Thompson, L. ..	2C	Cardiff
Wilks, John Hy.	1C	N.Shields
Woodman, D. R.	2C	Cardiff

August 27th, 1887.

Appleton, Nichs.	1C	N.Shields
Carmichael, John	1C	Glasgow
Corby, C. L. M.	1C	Aberdeen
Cowell, John R.	2C	London
Crosby, Harrison	2C	Sunderl'd
Curran, Edward .	1C	Liverpool
Davidson, Robert	2C	,,
Embleton, T. H.	1C	Sunderl'd
Haig, Robert....	1C	Glasgow
Harrison, H. S.	1C	Sunderl'd
Houghton, R. J.	1C	Liverpool
Lawn, Henry E.	1C	Sunderl'd
Lawson, James..	1C	N.Shields
McKendrick, W.	1C	Glasgow
Myers, Ernest ..	2C	N.Shields
Myers, Joseph ..	2C	London
Naysmith, Alex.	2C	Glasgow
Orr, Thomas	2C	,,
Patterson, G. M.	1C	Liverpool
Peed, Chris. B...	1C	,,
Prall, William ..	1C	London
Runcie, Fergus..	1C	Glasgow
Scott, William ..	1C	Liverpool
Thompson, R. S.	1C	Aberdeen
Timbs, W.S.O.G.	2C	London
Trevallion, C. W.	2C	,,
Vicary, Walter J.	2C	,,
Wall, John L. ..	1C	Glasgow
Wardropper, W.	2C	N.Shields
Young, Wm. H.	1C	Glasgow
Yuill, Andrew ..	1C	,,

September 3rd, 1887.

Connor, Hugh ..	1C	Glasgow
Duncan, John ..	2C	N.Shields
Fraser, Joseph ..	2C	,,
Fry, Fenwick C.	2C	,,
Holden, L. M. ..	2C	London
Jago, Joseph W.	1C	,,
Kirby, Wm. E...	1C	N.Shields
Kirkcaldy, James	2C	Glasgow
Leanzor, D. J. ..	1C	,,
Low, Robert	2C	N Shields
McCleary, Samuel	2C	London
McGlay, John ..	2C	Glasgow
Palmer, Henry I.	2C	N.Shields
Rous, Nicholas ..	1C	London
Simpson, William	1C	,,
Stainton, John I.	2C	N.Shields

September 10th, 1887.

Cant, Andrew ..	1C	Leith
Clarke, Adam ..	2C	Hull
Clarke, Chas. A.	1C	London
Drury, W. E. K.	2C	Hull
Haig, Geo. B. ..	1C	London
Hudson, Robert..	2C	N.Shields
Jeffrey, John....	2C	Leith
Kerr, John D. ..	1C	,,
McIntosh, Edw.	1C	,,
Miller, Robert ..	1C	,,
Mitchell, Wm. ..	1C	London
Porter, John	2C	Hull
Rapson, Richd. R.	2C	London
Robarst, J.......	2C	,,
Walker, Francis..	2C	Leith
Watson, Alex. ..	1C	,,
Wright, Wm. ..	1C	N.Shields

September 17th, 1887.

Armsden, J. H.	2C	Liverpool
Bowes, John	2C	,,
Caie, John......	2C	London
Carnochan, John	1C	Greenock
Dorward, Jos. E.	1C	,,
Gilroy, Malcolm	1C	,,
Grant, John	1C	,,
Halsall, Daniel R.	1C	Liverpool
Howarth, C. A.	2C	Greenock
Johns, John	C2	Plymouth
Laidlaw, Geo. B.	2C	Greenock
McClement, Thos.	2C	,,
McColquodale, D.	1C	,,
McIntyre, R. W.	1C	,,
McShee, Wm. ..	2C	,,
Primrose, Wm. B.	1C	,,

The Marine Engineer.
LONDON, NOVEMBER 1, 1887.

EDITORIAL NOTES.

THE President of the Manchester Association of Engineers, in his address to that meeting in Manchester, very fully recognizes the benefits that have resulted from the Government control of steam boilers. There has been, in the course of the last few years, legislation with regard to boilers, both on land and at sea, but the control conferred upon a public body, namely, the Board of Trade, has been much more searching and complete, with regard to sea-going boilers, than in the case of the land boilers. There is no doubt that all legislation which attempts to restrain or hamper private individuals or traders in the conduct of their business is irritating in its effect, and if badly administered may be made almost unbearable, and certainly would not be tolerated for a moment by the public, unless on a whole the public interest were well served thereby. This must be generally admitted to be the case, not only in the particular instance of the control of sea-going boilers, but undoubtedly must be admittedly the case as resulting from much other industrial legislation. For instance, the Alkali Works Act, it is generally admitted, has much mitigated the production of gas prejudicial to health and vegetation, and has led to the introduction of condensing apparatus, and other methods of utilization of waste products, which have saved many thousands of pounds per annum. The Mine and Factory Acts also are generally admitted to have been beneficial as regards the trades to which they have applied. Legislation now seems to be tending towards the obligatory registration and inspection of boilers on land with the same rigidity as is now enforced for boilers at sea. This Act, the character of which as now suggested has already been brought forward, but abandoned for the present, by Lord Stanley, is of the most drastic character, enforcing the necessity for every boiler being registered and numbered, so that any boiler may be traced from its date of manufacture to its ultimate destruction. It is proposed that it shall only be lawful to use a boiler after it has been inspected and a certificate obtained, and such certificate is only to be granted for a period of twelve months, and after rigid examination of the fitness and condition of the boiler. The carrying out of this Act it is proposed should be in the hands of the Board of Trade, and it is intended that this measure shall apply to every boiler used within the United Kingdom, with the exception of locomotive boilers or any boilers belonging to Railway Companies, or to those used in the service of Her Majesty. Should this Act be passed we do not see that it will make very much difference as regards sea-going boilers, as they are already placed under the absolute control of the inspectors of the Board of Trade, and no vessel carrying passengers is permitted to go to sea unless its boilers have been examined and certified by a Board of Trade engineer; and in case of disastrous explosion the formal enquiry is subject to a report by the Board of Trade engineer and surveyor. It is chiefly as regards a more rigid control of land boilers that this proposed Act, should it become law, will tend.

As we have already stated in many former issues, we have watched with considerable interest the formation and growth of the Marine Engineers' Union, which in its original conception seemed to be organized chiefly for the purpose of providing suitable club-houses where members of the profession might meet their colleagues in any port, and have the opportunity, so long as they might stay there, of passing their time in rational intercourse and pleasant amusement. We would wish it, however, to be clearly understood by our readers, that having no interest whatever in this Union and no direct association with the leaders and organizers of the movement, we think that many of their objects and some of their rules are by no means such as may recommend the movement to all parties who might otherwise have been glad to offer substantial countenance and assistance. It is frequently the tendency of trade organizations to render themselves, by too narrow a view of their position, antagonistic to interests outside them with which otherwise they might have co-operated; and we have little doubt in saying, that should the Marine Engineers' Union give rise to direct antagonism of a serious character, this will be certain to prove considerably to their detriment. We trust, however, that the leaders and organizers of the movement will display that sound common sense which may steer the Union clear of dangerous quicksands, and we shall be glad always to place our correspondence columns open to the exchange of ideas between the members of the Union, though at the same time we are strongly desirous not to be considered as directly associated with such movement.

WE are already beginning to find the effects of the latest modifications in marine steam engines and boilers in which now great ranges of expansion are sought in order to effect the greatest possible economy. The disastrous character of the bursting of the steam-pipe on board the *Elbe* may be certainly attributed to the unusual

high pressure for marine work at which the boilers of the *Elbe* were working. Cracks in steam-pipes are no unusual accident on board steam vessels, but they have seldom been accompanied by loss of life, the crack at low pressures giving ample warning, and being readily patched with lead or canvas until the broken part could be properly repaired and replaced. With the modern pressures of 150 lbs. per square inch, however, a crack in a large steam-pipe is a very different thing; the small crack spreads with lightning rapidity, and a volume of steam, or possibly scalding water, is discharged at a very high temperature, sufficient to cause instantaneous death to those who may be caught by it in the stokehold. As to the actual cause of the failure of the pipe there seems to be the widest difference of opinion. That there was a flaw in the metal or in the brazed joint seems almost a certainty, from the fact that a perfectly sound pipe of the dimensions should only have burst at 1,088 lbs. per square inch by calculation, while tested portions of the unexploded part of the pipe burst at pressures varying from 600 to 1,140 lbs. That portion breaking at the higher pressure presented a fracture of silky lustre, that is, of pure sound copper, whilst those parts that burst at the lower pressures presented a curious appearance as yet unaccounted for, some portion of the fracture being dark and dull, without apparent tenacity, whilst the remaining portion had a silky and metallic lustre, suitable to sound material. It has been suggested that this apparent flaw in the material has arisen from over-heating in brazing, but this is difficult to reconcile with the facts when the silky and sound portion of the metal was to the outside of the pipe, which is the part that is exposed to the greatest heat. As also the outside edge of the exploded fracture of the pipe was still sharp, this is assumed by an expert to be proof that the copper had not been over-heated, and that the lap-brazed joint had not firmly adhered. As most weaknesses in copper pipes develop in or about their brazed joints, either in their length or under the neck of the flange, we think it would be somewhat of an improvement in marine construction if the large steam-pipes now employed at high pressures were mechanically produced either solid, rolled, or drawn, or with a mechanically-secured lap joint. Brazing, like welding, is at least an uncertain and deceptive form of joint, the unsoundness of which is only generally discovered by disaster.

THE construction of torpedo boats is still being pushed forward with great energy by both English and the various Continental marine powers. We see that Spain has lately acquired two torpedo boats, completed by Messrs. Yarrow & Co., of Poplar, which are on the type of the largest and fastest torpedo boats in the British Navy. As was to be expected, it has been found that for the development of the excessive speeds required for these boats hulls of considerable strength are required, more so than is usually provided in vessels of this class. The speed developed by the two boats completed for the Spanish Navy has been most satisfactory, having amounted to twenty-four knots in a boat of only 135 ft. in length. This is by far the best result, as far as we know, that has ever been obtained in a vessel of such dimensions. Had the length been greater probably a still higher rate of speed could have been obtained, but it was naturally desired by the authorities to keep the vessels within the smallest possible dimensions. From the excellent sea-going qualities of one of these boats which has already steamed out to Spain, having encountered very bad weather, we have good reason for believing that the attention paid to the strength of the hull has been amply warranted by the exceptional sea-going qualities of the vessel. There is little doubt that in many cases the strength of torpedo boats has been injudiciously sacrificed to excessive speed, and that efficiency in actual service may often have been thereby endangered.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.

INAUGURAL ADDRESS*

By the PRESIDENT, W. T. DOXFORD, Esq.

CONSIDERING the great importance of the subject, I will, with your permission, refer to some of the points I had the honour of bringing before you twelve months ago. At that time I wished to show what prospect we had of improved trade for engineers and shipbuilders, and the figures which I then gave and the conclusion I then drew, though somewhat startling, I have not seen seriously questioned by any one of authority; indeed, in many cases they have been adopted by many eminent speakers and writers as substantially correct. It may therefore be instructive if I summarize as shortly as possible what I then said, and see how far my conclusions are supported by what has been done during the past twelve months.

In the first place I took the gross tonnage of the steamers then in Lloyd's "New Universal Register" of 200 tons and upwards as 9,855,560 tons, and showed:—

1.—That the general tendency was to increase the average size of steamers.
2.—That 44 per cent. of those steamers had been built during the years 1881-6.
3.—That at least 3,000,000 tons of steamers required to be re-engined, or to have their present engines altered to triple expansion.
4.—That the gain to the owner would be at least 30 per cent. per annum upon the cost of alterations.
5.—That there should be an average of £2,000,000 per annum spent over alterations and repairs during the next ten years.

I am not now going to deal with each of these points, but only with that one which is of most importance to us at present, viz., the amount of work to be done to old steamers to render them efficient.

It is important to us to know what proportion of that work has been done since the beginning of 1886, and to thus ascertain how far shipowners have appreciated their position.

* *Read before the Institution at the Annual Meeting, Oct. 19th, 1887.*

Unfortunately, I have not got complete returns for the whole kingdom, but I find that the following vessels have been or are being altered on the East Coast, Clyde, and Mersey, and at Aberdeen, viz.:—

Steamers.	Gross Tonnage.	
6	about 5,652,	have been re-engined with compounds.
24	,, 50,399,	,, ,, ,, triples.
2	,, 5,632,	,, ,, ,, quadruples.
41	,, 94,517,	have had old engines altered to triples.
5	,, 11,106,	,, ,, ,, quadruples.
Total 78	167,306	

Say 3 per cent. in numbers of estimated total and 5½ per cent. in tonnage, showing that it is the larger class of vessels which is being altered. The percentages appear small, but they will increase year by year as owners become convinced of the necessity of incurring the expense.

It is interesting to note that practically all the alterations are being made to triples, the reason being that there is no gain in using four cylinders with present pressures of steam.

It is further interesting to note that the East Coast more than holds its own in this special class of work, the seventy-eight vessels being divided as follows, viz.:—

Altered on North-East Coast	.. ..	43 vessels.
,, Clyde	.. ..	17 ,,
,, Mersey	.. ..	14 ,,
,, at Aberdeen	.. ..	4 ,,

This certainly should be satisfactory to the members of this Institution, showing as it does the favourable position this district now stands in.

Whilst on this subject it may be of interest if I give you the following figures for vessels built during the past and current years, or now in hands, as further showing the rapid change to triple-expansion, viz.:—

	Fitted with Compound Engines.	Fitted with Triples.	Fitted with Quadruples.	Total.
On the North-East Coast	69	244	—	313
,, Clyde	42	85	7	134
At Liverpool	7	15	—	22
,, Aberdeen	—	5	—	5
	118	349	7	474

Again we see the East Coast well in front of other districts, the triples, as compared with compounds, being nearly as four to one against only two to one elsewhere.

Although the figures I have dealt with do not represent the total for the kingdom, they are, I think, near enough to that total to give us an idea of what has been done, and after considering them no owner need hesitate as to which type of engine to adopt if he wishes to keep up with the times, for it may be taken for granted that the greater part, if not the whole, of the 118 compounds are compounds simply because they were built or contracted for before the triples had definitely proved their superiority.

As regards the gain to the shipowner, I have seen nothing to cause me to modify the opinions I expressed twelve months ago, but a great deal to confirm them.

Allow me here to thank Mr. W. Parker, of Lloyd's, who has specially collected the statistics from which the above figures have been condensed, for without his assistance, which was given with his usual readiness to assist others, it would have been impossible to get such reliable data.

Now let us turn to another important subject, viz., the comparative tonnages of 1886 and 1887. This question has been much dwelt on lately; nevertheless, the following figures will probably be of interest to you, showing as they do the increase or decrease in each class more clearly than I have seen them put before:—

	1886.	1887.
Total Steam Tonnage of Wood ..	356,307	380,655
,, ,, Composite ..	32,010	32,820
,, ,, Iron ..	8,907,199	8,911,406
,, ,, Steel ..	995,725	1,206,962
Total	10,291,241	10,531,843

= 240,602 increase in steamers.

	1886.	1887.
Sailing Ship tonnage of Wood ..	8,606,225	8,104,060
,, ,, Composite ..	131,034	126,651
,, ,, Iron ..	2,396,179	2,078,777
,, ,, Steel ..	83,177	102,319
Total	11,216,615	10,411,807

= 804,808 decrease in sailing vessels.

Showing a slight increase in each description of steamer, but a large decrease in all classes of sailing vessels with the exception of the steel class, which shows a slight increase.

Now these figures show a considerable decline in the gross tonnage of the world, and, therefore, if the present depression was caused by an excess of tonnage, this is now being gradually rectified.

But, say some, we now as shipbuilders have a formidable foreign competition to contend against; and, as there has been great anxiety displayed about the development of shipbuilding in foreign countries, let us examine what has been done during the past year as regards the new tonnage built.

Taking the following six countries, I find that the new vessels added to their fleets were:—

		Built in United Kingdom.	Built elsewhere.	Of these latter built of Wood.
United Kingdom	Sail ..	91,838	395	395
,, ..	Steam ..	205,945	1,432	1,432
France	Sail ..	2,408	1,347	1,347
,, ...	Steam ..	4,007	10,910	266
Germany ..	Sail ..	——	12,939	4,479
,, ..	Steam ..	16,942	31,057	——
Italy	Sail ..	1,527	5,555	5,555
,, ...	Steam ..	4,879	——	——
Norway ..	Sail ..	——	5,850	4,618
,, ..	Steam ..	——	1,470	359
Sweden ..	Sail ..	——	1,262	1,262
,, ..	Steam ..	197	4,056	203
Totals	..	327,743	76,273	19,916

So that, out of a total of 404,016 tons registered by these six countries during the year 1886-7, 327,743 tons were built in the United Kingdom and 76,273 tons were built elsewhere; but out of these 76,273 tons no less than 19,916 tons were wood or composite, leaving only 56,357 tons of iron and steel vessels built out of, as against 327,743 built in, the United Kingdom.

	Tons.	Built in United Kingdom.	Built elsewhere.
Of these France built for herself	10,644	6,415	——
,, Germany ,, ,,	37,207	16,942	2,310
,, Norway ,, ,,	2,343	——	——
,, Sweden ,, ,,	3,378	197	475
Total	53,572	23,554	2,785

From these figures we find that Germany and France are the only countries which produce any appreciable quantity of iron or steel tonnage, although Sweden and Norway produce what little they require for their own use; that Germany is fast becoming a shipbuilding country, already producing two-thirds of her fairly large requirements; and that France produces less than two-thirds of her requirements, although these are less than one-third of Germany's.

We further find that no country in the world, excepting the United Kingdom, is at present able to supply a market outside of itself, and that, therefore, with the exception of the four countries named, the whole world is dependent upon the shipbuilding yards of this country for its fleets.

To put it in another way, the total tonnage of iron and steel vessels is 10,118,012 tons, of which 3,631,963 tons are owned by foreigners; or say, 31·25 per cent., whereas the percentage of tonnage built last year by foreign countries was only 17 per cent., so that the remark made by the noble President of the Institute of Naval Architects, in his address on the 30th March, this year, viz.:—"Formerly, England used to build ships for all the world, and now all the world is building ships for itself" is hardly correct, and I am sure that no one will be more pleased than his lordship to know this. Now, although his lordship's words may not be correct at the present moment, they may only too soon become true; for though we probably need not fear competition from France, assuredly we may fear it from Germany, even if not

from Norway and Sweden, where they have the material and also a hardy population. Spain will also try to compete with us, especially on the northern coast, where she has raw material at hand, and has already erected blast-furnaces and rolling mills. The climate may be somewhat against her, but everything else is in her favour; for although the iron ore may soon become sufficiently scarce to make it less able to compete in this country with our native ores in price, it will assuredly supply all home demands for many generations to come.

And what of America? Although her present fiscal policy practically prevents her having a mercantile fleet at all, were this changed we might have a very large demand to supply for a time, but this would be only temporary, as she would ultimately produce at least the greater part of her tonnage requirements, even if she were unable to enter into competition with us in other markets.

Well, then, we have arrived at this point. We have a decreasing tonnage which must assuredly lead to an increased demand. We have the possibility of an abnormal demand from America, and we have the fact that no country excepting the United Kingdom is in a position to supply a demand outside of itself at the present moment. The outlook for the immediate future, therefore, should not be discouraging to shipbuilders and engineers. But we must not expect the large demand and high prices we had four or five years ago, for the world is proportionately better supplied with tonnage than it has ever been before, and assuredly as soon as there is a tendency for prices to become excessive we will see an enormous development in the production of foreign countries; it is only by keeping our prices down, whilst we at the same time maintain the lead in all improvements, that we can keep other countries in check, and so retain the bulk of the trade in our own hands.

Now let us see whether or no we are keeping ourselves well to the front in all improvements, and to do so we must not be afraid of pitting ourselves against the world at large. Now the question of steel *versus* iron is one of the most important questions of the day, and is being undoubtedly settled in favour of steel. Then how do we stand upon this question? Well, there were built last year in—

	United Kingdom. Tonnage.	Elsewhere Tonnage	Whole World. Tonnage.
Steel vessels ..	211,242 ..	24,505 ..	235,747
Iron vessels ..	186,160 ..	43,248 ..	229,408
Wood and composite vessels	2,309 ..	75,618 ..	77,927
Total	399,711	143,371	543,082

These figures clearly show that we are not slow to adopt improvements but rather that we are much more ready than the rest of the world to do so; for whereas we have practically ceased the building of wood and composite vessels, more than one-half of the total built elsewhere are still of these obsolete types, and iron vessels are nearly as two to one of steel, whereas we are building considerably more of steel than of iron.

Whether we can keep our costs down or not so as to continue to compete favourably with other countries in face of their lower wages, longer hours, and increasing facilities for the production of the necessary materials, I dare not predict, for time alone can tell.

Now, as regards steel, you are well aware that there are two methods of producing it for shipbuilding purposes—one the acid process, the other the basic process, and to both of these methods of producing steel either the Siemens-Martin process of converting or the Bessemer process of converting are applicable.

Up to recently we in this district were placed at a considerable disadvantage as against our friendly rivals on the Clyde by the introduction of acid steel made by the Siemens-Martin process, owing to the difference in carriage, that material not being then produced in this neighbourhood; but fortunately, by the energy and foresight of the Consett Iron Co., Messrs. Palmers, and others, we are now in even a better position than our friends on the Clyde. But that is not all. You will all remember the two able papers read in Sunderland on the 27th July last, one by Mr. W. H. White "On some recent experiments with Basic Steel," and the other by Mr. B. Martell "On the present position occupied by Basic Steel as a material for Shipbuilding." These were both important papers in that they helped to restore faith in a material the manufacture of which is peculiarly favourable to this district on account of the enormous beds of ore in the Cleveland Hills, which otherwise could not be utilized in the manufacture of mild steel. Basic steel has been, to say the least of it, under a cloud, owing to a want of uniformity in its quality; but Mr. White showed that uniformity was obtainable with care, and that this make of steel was being used by the Admiralty, and Mr. Martell, although pointing out the difficulties that Lloyd's had had to contend with in the past, spoke much more hopefully of the future, having had some very satisfactory experiments made at one works, which showed that good reliable basic steel could be made if proper means and care were adopted in its manufacture. When we consider the important positions held by the gentlemen who read these papers, one being the head of the constructive department of the Admiralty, and the other the chief surveyor of Lloyd's, and further, the standing of the eminent gentlemen who carried on the discussion, I think that the result cannot be otherwise than beneficial to the steel trade of this district, and we may fairly congratulate ourselves on having had something to do with the bringing of it about.

Bearing on this question of steel it may be interesting to look back a few years, so as to realize the advances which have been made. Now, I was very much struck by the following words written by Mr. Parker of Lloyd's, not ten years ago, in a paper read before the Institution of Naval Architects, "On the use of Steel for Marine Boilers." They were these:—"The pressures meanwhile have been slowly but steadily advancing from 60 lbs. to 75 lbs., now a common pressure, and in a few instances 90 lbs. has been reached. But up to the present all attempts which have been made with new forms of boilers, with the view of obtaining still greater pressures, have uniformly been signal failures. The recent adoption of mild steel for marine boiler making, however, will enable the present form of boiler to be made of greater strength, and gives promise of further advancement in the direction of higher pressures; and if experience is satisfactory as regards the comparative durability of steel and iron boilers, it may not unreasonably be expected that this material may become almost universally used for their construction. Some months ago the employment of steel for such purposes was ventured on by only one or two firms, but it is now coming into more general use." Then, after referring to the recent improvement in the furnace, viz., that patented by Mr. Sampson Fox, and now universally used, he goes on to say:—"If the improvements I have indicated prove, as I have little doubt they will prove, successful, we shall have gained an advantage represented in the aggregate by an increase of about 80 or 90 per cent. of the working pressure. In other words, we shall be able to work the present form of boiler at 160 lbs. or 170 lbs. per square inch; and, although the resultant economy will not be so great as that which attended the increase at one step from 30 lbs. to 60 lbs., we may confidently anticipate that it will be sufficient to give a great impetus to steam navigation, advancement in which has been so much retarded by the high consumption of fuel."

Could any words have been more strikingly fulfilled? 160 lbs. is now an ordinary pressure, and every boiler without exception is made of steel! Nothing could show better the great foresight of the writer or the enormous advance which has taken place since the paper was written.

The successful introduction of steel has then given us the 160 lbs. pressure, and this again has enabled us to introduce the triple-expansion engine which has been so much written about, and which has proved so eminently successful in every way. But we are not to stop here, for there is no finality in such work as ours. Then in what direction are we now to move? Well, without going into the question of an improved boiler, which may some day enable us to safely work up to much higher pressures than we are now using, we have three important directions in which it has been suggested we may work for improvement, viz.:—

Forced draught;
Increased piston speed;
Reduced weights.

Taking first the application of forced draught. This would materially reduce the weight of boiler necessary for a given horse-power, and members of this Institution have done something, I am proud to say, towards its satisfactory introduction. In the first place, the subject was forcibly brought before us in the first Presidential Address to this Institution, and this was followed up by the able paper by Mr. James Paterson and Mr. Magnus Sanderson last year, who expressed as their opinion that "forced draught is destined ere long to supersede almost entirely the use of natural draught." This paper was followed by a more than ordinarily interesting and able discussion, which was taken part in by some engineers of considerable experience in this special subject, who one and all appeared to be of opinion that forced draught would ere long be adapted to mercantile steamers with economical results.

Now, although that paper has been followed up by others upon the same subject read before other institutions, it is not yet exhausted, and should be kept well before us, and it behoves us to consider well whether or no we can act upon the suggestion thrown out by the authors, viz., "carefully conducted experiments on the lines indicated. This, surely, not being beyond the scope of an Institution with a membership of upwards of 500, amongst whom are representatives of all the leading firms on the North-East Coast."

Since these words were written several more or less satisfactory experiments have been made in various parts of the country. One I will specially mention as showing the great importance of persevering in the face of the greatest discouragement. There were two new steamers built for this experiment identical in every way, excepting that one had forced draught fitted to her boilers and the other had not.

The boilers with the ordinary draught burnt 10 tons per day, and those with forced draught on the first trial 12 tons. Well, this result, with ordinary people, would have settled the question as far as they were concerned in favour of ordinary draught; but, fortunately, these experiments were continued with the view of finding out the cause of the excessive consumption, and the pressure of air was reduced from 2½ in., at which the first trial was made, to half an inch. The furnace bars were lengthened, baffle plates, or retarders, as they are called, were fitted in the tubes, the air openings from the fans to the furnaces were enlarged, and a number of other alterations were made from voyage to voyage, until the consumption fell to 8 tons, or 33 per cent., a saving of 20 per cent. over ordinary draught. This experiment showed that with that type of boiler a low forced draught was most economical, the result of course depending in a great measure upon the proportion of heating to grate surface. This experiment would show that a considerable saving in fuel may be effected by the judicious employment of forced draught, a result which has been doubted by many.

Now, I wish to impress upon you the great importance of this question of forced draught, because it is probably *the* debatable question of the day; and as in the vessels that have been fitted with it, where owners have persevered in order to obtain the best result, it has been clearly demonstrated that its principles are sound, it will, I think, mark the next decided step in advance in marine engineering. The possibilities it may lead to are as yet unknown, for we have not yet got over all its difficulties; there is therefore ample scope for experiment in this direction.

As regards the other two questions, viz., increased piston speed and reduced weights, I do not feel myself competent to speak, for where eminent engineers differ in opinion, as they do upon these subjects, it would be dangerous for one not an engineer to express a decided opinion. But when we consider that in Mr. Hall's paper, read April 20th, this year, before our Institution, he gave the weight of triples, as used in the mercantile marine, at 450 to 460 lbs. per H.P., and that Mr. Marshall, in his paper read in this room, on the 26th July, before the Institution of Naval Architects, shows that by forced draught and higher piston speed his firm has reduced the weight in war vessels to considerably under 200 lbs. per H.P.—in two special cases as low as 84 lbs. per H.P. !—although for many reasons it is not advisable for us to aim at reducing mercantile engines to anything like the weight of those put into war vessels, yet there must surely be room for some saving between 460 lbs. and 200 lbs. per H.P.—probably by using stronger material—without endangering the strength of the machinery.

Now, gentlemen, it is very difficult for one in my position to tell such an audience as this anything entirely new, and I hope that you did not expect it. All one can do is to make a brief reference to such questions of the day as are likely to be of interest, and to combine the historical with the suggestive. I hope I have in some slight degree been successful in my attempt.

Mr. M. J. Minieri, of 3, Kaasbrug, Antwerp, desires us to inform our readers that in assuming the management of the Prince of Wales Hotel, Antwerp, he has not relinquished his business at the Kaasbrug. We understand that the Hotel was once a favourite resort for marine engineers, but that long-continued mismanagement lost it their support. We trust that Mr. Minieri, himself a sea-going engineer of long standing, will succeed in placing matters upon their old footing. He has our best wishes in his new venture.

LAUNCH OF H.M.S. SPIDER.

On October 17th was launched the *Spider*, the torpedo gun-vessel, a sister ship to the *Sandfly*, launched at Devonport Dockyard on the 30th of September. The ceremony, which was performed by Miss Minnie Hay, daughter of the Naval Commander-in-Chief at Devonport (Admiral the Right Hon. Lord John Hay, G.C.B.), was favoured by exceptionally fine weather, which drew together an unusually large number of spectators. Around the bows of the vessel, which was laid down in that portion of the yard known as the New Ground in June of 1886, were erected the customary platforms for the ticket-holders, and among those present were Admiral Lord J. Hay, Admiral Sir W. Dowell, Admiral Hillyar, Rear-Admiral H. D. Grant, Inspector-General Haran, R.N., and the Mayor of Devonport. Captain Burniston was in charge of the arrangements on board the ship, and Mr. J. B. Huddy, chief constructor, aided by Messrs. Cock and Newnham, constructors, and Mr. Black, assistant-constructor, who has supervised the erection of the vessel throughout, superintended her launch. Shortly before 5 o'clock, after the usual prayers had been read, Miss Hay, a little girl, was led on to the launching platform by the Admiral Superintendent, and forthwith proceeded to dash the bottle of wine against the sides of the vessel, naming her the *Spider*. Subsequently, Miss Hay was handed a finely-carved box of satin wood and ebony containing a chisel and mallet. A tap or two with the mallet on the head of the chisel severed a cord, the dogshores were knocked away, and the *Spider* glided down the slip into the water. Hearty cheers were raised by the onlookers, and "Rule Britannia" and "God Save the Queen" were played by the band. On getting into the waters of the Hamoaze, the *Spider* was taken in tow by the *Scotia*, dockyard tug, and moved to moorings in the stream. The *Spider*, which was launched with her engines in her, is in a most forward state, and is the fourth vessel of the *Rattlesnake* type now afloat. Her engines, which are by Maudslay, are expected to give a speed of over 19 knots, and by the time the vessel is ready for sea she will have cost about £36,000. The *Spider* is built entirely of steel, with half-poop forecastle, conning tower, and conning bridge. She is of 450 tons displacement, 200 ft. in length, 23 ft. in breadth, and of 8 ft. draught. The depth of hold is 13 ft., the thickness of the sides varies from half to three-quarters of an inch, and the weight of the hull is 225 tons. The vessel will carry one 4-inch breechloading gun, mounted on the Vavasseur central pivot system behind a steel screen in the bows. This gun has a muzzle velocity of 1,100 ft. per second, and throws a bolt which weighs 25 lbs., and which is capable of piercing three inches of unpacked iron.

NEW SPANISH WARSHIP.

The trials of the new Spanish warship *Reina Regente*, built by Messrs. J. & G. Thomson, of Clydebank, have been carried on during the week ending October 8th, in the Firth of Clyde. The vessel is 307 ft. long between perpendiculars and 330 ft. long over all, 50½ ft. broad, and 32 ft. deep. With her normal quantity of coal on board, and all her guns and stores and provisions for three months, her displacement would be 4,800 tons. Her four 24-centimètre Hontoria guns, which are being made at Elswick after a Spanish design, will not be ready for six months, but six 12-centimètre guns of the same character were in place, besides eight 6-pounder Nordenfelt rapid-firing guns, two Hotchkiss revolvers, and eight small guns, including four in the military peaks. She is armed also with five torpedoes, and her armour consists of a protective deck springing 5 ft. 6 in. below water at the sides, where the plates are 4¾ in. thick, to 1 ft. above the water line in the middle, where the plates are 3½ in. thick. The big guns are protected by shields 3 in. thick, and the smaller by 1 in. thick shields. Artificial weights were placed on board to represent the absent guns and stores and the draught was 5·9 mètres forward and 6·2 mètres aft, which is said to correspond with our Admiralty legend draught.

Her motive power consists of two sets of triple-expansion horizontal engines working twin screws, served by eight double-ended boilers with 32 furnaces, designed to work to 140 lbs., but actually working with forced draught 130 lbs. She is designed to take 1,200 tons of coal on an emergency, but the normal quantity is 500 tons. On her speed trials she made five runs on the measured mile with forced draught, and a run of two hours, also

[illegible] the same day. On the day set apart for [illegible] four runs on the mile and steamed [illegible] forced draught the mile was run the first [illegible] was thrown out, and the succeeding [illegible] respectively in 2 min. 58 sec., 2 min. 56½ sec., [illegible] The average of the five runs [illegible] 13 knots with forced draught. The [illegible], and the average of screw revolutions [illegible] The instruments recorded 12,564 [illegible] two hours' steaming, or an average of [illegible] Under natural draught the four runs on the [illegible] 16 sec., 3 min. 8 sec., 3 min. 10 sec., [illegible] two runs with and two against the tide, [illegible] of 18½ knots, with 94·37 revolutions per minute, [illegible] During the six hours' run with natural [illegible] the distance between the Cumbrae Light and Ailsa Craig, [illegible] was run with the tide, in an hour and 28 minutes. The return journey was made on a devious course and could not be computed with accuracy by the lights; but the representatives of the Spanish Government computed the speed of the six hours' run to be 13·08 knots. Mr. White, the Director of Naval Construction, was present during the forced draught trials.

LAUNCH OF H.M.S. SANDFLY.

On the afternoon of September 30th H.M.S. *Sandfly* (torpedo gun vessel) was successfully launched from one of the building sheds on the new ground at Devonport Dockyard, in the presence of a large number of spectators. Platforms were erected round the bows of the vessel, one of which was occupied by the boys of the Mount Edgcumbe industrial training ship, with their brass band; another opposite by the band of the 2nd Volunteer Brigade, Western Division, Royal Artillery, which, prior to the vessel leaving the stocks, played, under the direction of their bandmaster, Mr. G. T. Ball, a capital programme of music; while the remainder were taken up by privileged spectators, among whom were Rear-Admiral H. D. Grant, C.B., Admiral Superintendent of the yard; Mrs. and the Misses Grant, the Earl and Countess of Morley, the Ladies Albertha and Edith Edgcumbe, the Hon. R. Edgcumbe, the Mayor of Devonport (Mr. J. W. W. Ryder) and the Mayoress, Miss Clarke, the Mayoress of Plymouth, Mrs. Alger, Miss Alger, Admirals C. Wake and Hillyar, Rear-Admiral Burley Grant, Inspector-General Haran, Royal Naval Hospital, Stonehouse, and other ladies and gentlemen. Promptly at 4 p.m. the chaplain of the yard (the Rev. Dr. [illegible]) came on to the launching platform, and read the accustomed form of service. This over, Miss Huddy, the daughter of the Chief Constructor of the yard, who was to perform the ceremony, stepped on to the raised dais, and dashed a bottle of wine against the bows of the vessel, naming her the *Sandfly;* whereupon, at the call of Admiral Grant, three cheers were given. A handsome wreath was affixed to the bows of the vessel, and above this was the royal coat of arms beautifully carved. Running across the centre of the coat of arms was a cord, and this Miss Huddy proceeded to sever with a chisel of satin wood, finely carved, and mallet to match, which had been previously presented to her in a box of satin wood and ebony. When it was ascertained that all was clear, Miss Huddy severed the cord, and this had the instant effect of setting a hidden lever in motion, causing two heavy weights to drop and knock away the dogshores. The vessel, thus freed, glided away, and took the water in graceful style, amid the strains of "Rule Britannia" from the band and the chorus of the assembled onlookers. Staff-Captain Barniston had charge of the arrangements on board, and on her getting into the Hamoaze the *Perseverance* dockyard tug took her in tow, and placed her at moorings in the stream. The *Sandfly* was launched with her engines—which have been supplied by Messrs. Maudslay, Son, and Field—in her, and most of her internal fittings intact; in fact, she is in a most forward state, and in a very short space of time could be got ready for commissioning. She and her sister ship, which is called the *Spider*, were laid down in the new ground within a few weeks of each other in 1886, the *Sandfly* having been commenced in May and the *Spider* in June of that year. The *Sandfly* is a steel vessel of the *Rattlesnake* type, and was designed by Messrs. Barnes & Morgan, of the Constructive Department. Originally it was intended to style this class of vessels "torpedo boat catchers," a designation which has latterly been changed to "torpedo gun vessels." She would have been built within 12 months of her being commenced, had it not been for the delay on the part of the Admiralty in making the contract for the supply of her machinery. The *Sandfly* is 200 ft. long, her extreme breadth is 23 ft., and she has a displacement of 450 tons. She is built of steel from half to three-quarters of an inch in thickness; the weight of her hull being about 225 tons; her lines are very fine and altogether she is beautifully modelled. The draught of water is 6 ft. 6 in. forward and 9 ft. 6 in. aft, giving a mean draught of 8 ft. Her machinery is of the new triple-expansion type, acting on twin screws, and will develop 3,000 H.P., with a speed of 19 knots. Her coal-carrying capacity amounts to 100 tons. Her total cost when ready for sea is estimated at about £36,000. The *Sandfly* is fitted with a powerful electric light projector, and is also to be provided with steam steering gear. Her armament will comprise one 4-in. breechloading gun, on Vavasseur central pivot mountings, to be placed in the fore part of the vessel; six 3-pounder quick-firing guns, two of which will be fitted aft, two amidships, and two forward; and eight 14-in. Whitehead torpedoes, which can be fired from four tubes, fitted one each at the bow and stern, and two amidships.

BOILERMAKERS AND IRON SHIPBUILDERS.

The monthly report for October, of the United Boilermakers and Iron Shipbuilders' Society has just been issued. The report states that the returns from the north-east coast show but little change since the last issue, so far as the employment of a large number of members is concerned. Some important contracts, however, have been booked towards the end of the month, which will provide more work after a few weeks. In some of the yards the winter prospects are good, but that cannot be said of a large number. Since the last report several contracts have been secured by Clyde builders. These contracts and a few others that are expected to come to the Clyde, have produced a more hopeful feeling in certain quarters, and a revival of trade is being somewhat freely talked about. At Liverpool and Birkenhead there is not any change for the better. Wages and materials are probably at their lowest, and intending buyers are recommended to contract while the opportunity remains with them. The figures in the Board of Trade returns showed that some real improvement in trade had certainly taken place, and perhaps the most important of these figures were those relating to the imports of raw material to be worked up into the manufactures of the country. The increase of imports during the eight months ending at August, as compared with the corresponding months of 1886, was no less than five and a half millions in value. During the past month three new branches have been opened, one at the Tilbury Docks, East London, the second at Troon in Ayrshire, and the third at Londonderry. The trade report of the Tyne, sent by the District Committee, states that about 50 more members were employed than last month; still, about 500 men were out of employment. Some of them had worked very little for three years back, and how they had pulled through was a mystery to others and themselves. There were good prospects of work at Palmer & Co.'s, Jarrow; Hawthorn, Leslie & Co.'s, Hebburn; Edwards & Son's, Howdon; and Readhead's firm, South Shields. The district report concludes:—The boiler shops, on the whole, are not in a bad position, some of them even working overtime, when unavoidably required to do so. In regard to repairs, Hawthorn, Leslie & Co. have had a good run for six or eight weeks in their dock and in the river; next to them comes Edwards & Co., South Shields, where the men have been acting very foolishly in contracting, estimating, and cutting one another out; the Shields branches must send the names of any members doing so to the district committee, as the disease is very contagious in times like the present, and should not be allowed to take root in any part of the Tyne.

The American "Mechanical Engineer" asks, "What has become of the Marchant engine that was to turn the engineering world inside out?" Shall we "give it up?" or shall it be asked in reply, What has become of the Keeley motor?

THE NEWCASTLE - UPON - TYNE ROYAL MINING, ENGINEERING AND INDUSTRIAL EXHIBITION.

TANGYES LIMITED, Cornwall Works, Birmingham, and of London, Newcastle-on-Tyne, Manchester, Glasgow, Paris, Sydney and Melbourne, had, as may be anticipated, one of the largest and -most varied collections of machinery in the Exhibition. In arranging their exhibits, Tangyes, in the first place, erected one of their Cherry's Overhead Travelling Cranes, which had been previously tested to five tons, and which, while being an important exhibit, was also of the greatest use in facilitating the placing of the heavier exhibits. This crane is remarkable for its snugness, neat appearance, and the smooth and easy manner with which it works, one man being capable of lifting five tons. It is fitted with longitudinal and cross travelling gear, so that the weights can be picked up at any point and conveyed to any other within its range. The largest exhibit is a 40 H.P. Tangyes' Horizontal Steam Engine, fitted with variable expansion gear, on Meyer's principle, and, while it is a splendid specimen of engineering skill, it is only a fair sample of the firm's regular work. No doubt this type of engine is new to many steam users in the north, as none of them are as yet at work in the Newcastle-on-Tyne district, the engine by which Tangyes are more generally known differing in its design, as well as having less power. The fly wheel of this engine is 12 ft. diameter and 2 ft. wide, made in two halves, and the crank disc, which is polished, is constructed so as to balance the connecting rod. We regret that pressure on our space prevents our illustrating and fully describing this engine, which appears to be admirably adapted for driving machines in engineering and shipbuilding shops. Almost equally interesting is the double-cylinder Belfast Engine, which is also fitted with Meyer's expansion gear. This engine is designed and constructed so as to work on a wall or horizontally. It takes up the *minimum* amount of space, couples direct to the shaft, is perfectly rigid, has large wearing surfaces, and is thus adapted for high steam pressure, and correspondingly high speed of revolutions. Similar engines to that exhibited have been supplied to many firms in the north-east coast district, including Sir William Armstrong, Mitchell & Co., Limited, and R. & W. Hawthorn Leslie & Co., Limited. A smaller engine exhibited is an 8-horse power horizontal, with the Tangye-Johnson automatic expansion gear, remarkably simple in its construction, and which has given every satisfaction to numerous purchasers. The special engines of Tangyes, however, appear to be innumerable, when it becomes necessary to describe them, and we must pass over a number, only mentioning that among them are the "Archer," the "Cornwall," and the "Column," each of which are engines specially designed for driving dynamos for electric lighting, or for driving centrifugal pumps, fans, &c., in Admiralty and other work. We would, however, call special attention to one of their "Archer" engines exhibited in combination with a 10-inch Tangye's centrifugal pump, to which it is coupled direct, as being a speciality admirably adapted for use in salvage operations. Three of the exhibits of Tangyes Limited, viz., the Tangye Gas Hammer, Tangye's high-lift "Colonial" fly-wheel pump, and Tangye's duplex pumping engine, are of very recent design, and as we consider the two first mentioned would be specially interesting to our readers, we fully describe and illustrate them. In the Tangye Gas Hammer we see a development in the use of gas and air, which promises to assist in displacing steam as a motive power in shipbuilding, engineering, and mechanical operations generally. What with electricity, petroleum and gas engines, it would appear that in the not far-distant future no great field of usefulness will be left for steam. Be this as it may, it is evident that there is even at present a scope for machines actuated by the explosive force of gas. There is reason to believe that, even when steam power is already at hand, it will be found more economical in the smith's shop to use a gas hammer for light work; for even when a mechanical hammer is well provided with work, the intermittent use of steam is not conducive to economy, whereas in the gas hammer there is only an expenditure in strict proportion to the force actually utilized. In works only partially employed, too frequently the case in these days of depression, the advantage thereby gained is greatly increased; and there is also a greater economy with a gas hammer as compared with one driven by steam, when the hammer is distant from the boilers, as is often the case in shipbuilding establishments, as a large percentage of the steam is lost by condensation in the system of piping. It will be also evident that a gas hammer will frequently be useful when works are laid in for repairs. It will, therefore, we think, be of interest to our readers to examine the principle upon which the Tangye Gas Hammer, the first of its kind, is worked. As will be seen from our illustration, fig. 1, in appearance it is hardly distinguishable from a well-designed steam hammer, the principal difference being that instead of steam, a mildly explosive mixture of common coal gas and atmospheric air is employed as the motive power to propel the hammer piston. The mixture of gas and air is introduced to the cylinder above the hammer piston by means of a second piston, actuated from a hand or foot lever, and then ignited. The pressure produced acts upon the upper surface of the hammer piston, and so forces it down to give the blow. After the blow the hammer is returned to its highest position by means of a spring, so that there is only an expenditure of gas in giving the blow, and not in lifting the hammer. Fig. 1 shows the Tangye Gas Hammer, made in accordance with Robson's patent and Pinkney's improvements, as at present manufactured, actuated by hand gear, which moves precisely the same as the hand lever commonly used in steam hammers for controlling the slide valve, and requires no greater effort, so that a boy can work it. The action of the hammer is as follows:—When the working lever is moved through its full range, the charging piston connected to it moves to the top of the cylinder, away from the hammer piston, and gas and air mixture flows in through an automatic lift valve, filling the space between the pistons. At the limit of its charging stroke a small hole in the cylinder is uncovered, and a Bunsen flame ignites the mixture through it.

FIG 1.

Under the pressure produced by the ignition, which in no case exceeds 70 lbs. per square inch, the hammer piston is driven downwards, and the hammer delivers its heaviest blow. In the case of the hammer exhibited at their stand, this blow is equal to that given by a weight of three cwts., falling through a height of one foot, a blow which can, we understand, be easily given at the rate of over 120 blows per minute. The force of the blow can be regulated as easily and as accurately as with the steam hammer, softer blows being given by reducing the range of movement of the hand lever, which simultaneously lessens the movement of the charging piston, and reduces the volume of the charge of gas and air. For the very lightest blows a relief valve is provided, which can be opened at will. In some cases it is an advantage to the smith to control the action of the hammer himself, instead of having a boy to do so, and a modified arrangement is supplied, when desired, to enable him to work by foot whilst having free use of both hands for handling the forging. With this foot gear precisely the same control over the force of the blow is obtained as with the hand gear. Our illustration of the Tangye Gas Hammer is taken from a drawing of the ¾-cwt. size, which at present Tangyes Limited are manufacturing, and which the makers confidently recommend for every kind of forging or stamping to which the steam hammer can be applied. Although nominally ¾-cwt., the blow actually struck is equal to three cwts. falling through one foot, so that the hammer is more powerful than a steam hammer of similar rated power. Tangyes Limited are not putting their gas hammer on the market without actual experience of its ordinary working capabilities, as, for more than a twelvemonth, one of these hammers has been almost continuously employed in the regular work of the smithy, doing the very hardest kind of work with the greatest possible efficiency; proving, beyond a doubt, that the gas hammer is capable of severe and continuous work, just as much as the steam hammer. As already indicated, where there is no steam power, Tangye's Gas Hammer will prove invaluable, both in first cost and cost of working, the latter being much less than in the case of a steam hammer, either regularly or intermittingly at work, 3,000 of the heaviest blows only using 33 cubic feet of Birmingham gas, which, at 2s. 6d. per 1,000 cubic feet, costs one penny. A week's hard work will only entail an expenditure of about four shillings for gas, and there the outlay ends, while, with a steam hammer, besides the expenses incurred for fuel, boiler attendance, transporting of ashes, packing of stuffing-boxes, &c., there is a tolerably constant dropping of condensed water from the hammer piston-rod on the forging. It should not be overlooked that the gas hammer *is always ready for work at any moment*, day or night, for short or long periods, and that it works in the same economical rate for one blow as for one thousand blows. All that is necessary is to light the Bunsen flame, open the gas-cock, and the hammer is ready for action.

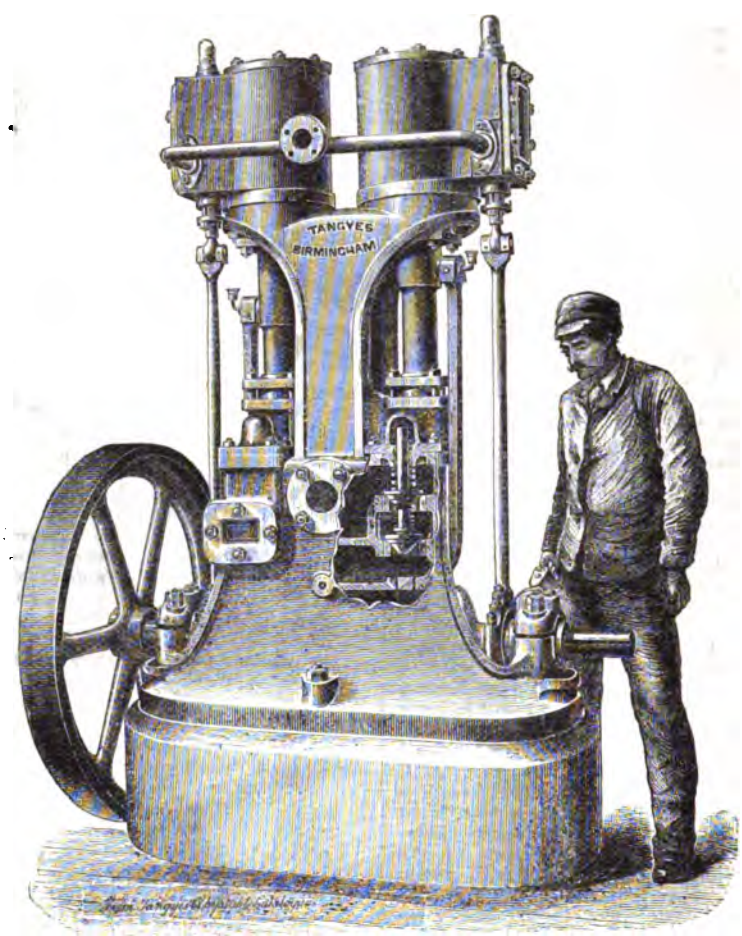
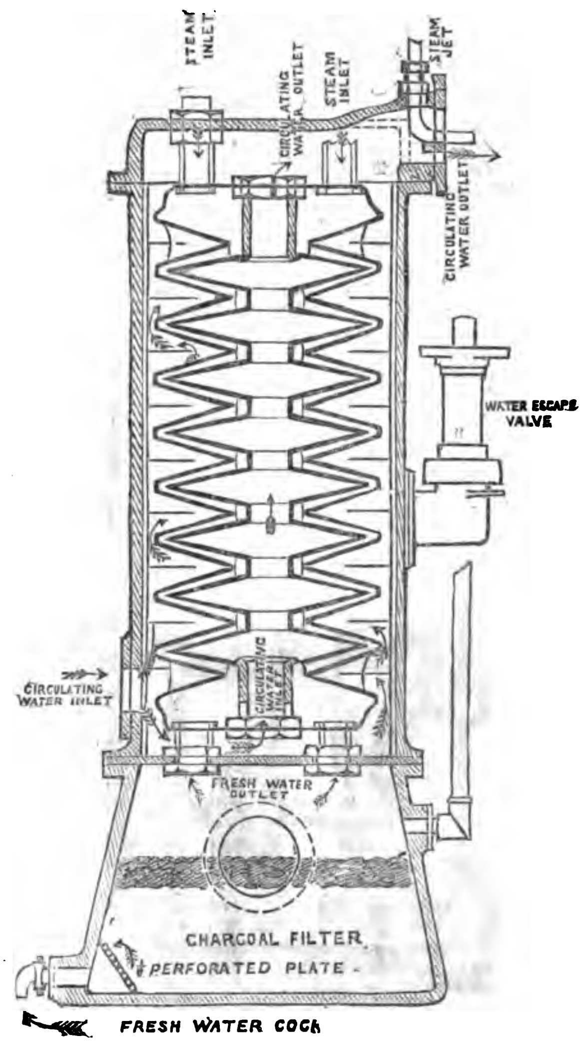


FIG 2.

Having so fully described the Tangye Gas Hammer, a briefer account must suffice for Tangye's high-lift "Colonial" fly-wheel pump, of which we give an illustration, fig. 2. These pumps are made of various sizes, capable of delivering from 2,400 to 22,000 gallons per hour, but our illustration is taken from a photograph of one capable of easily delivering over 6,000 gallons. It will be seen that the Tangye's high-lift colonial pump is of the vertical double-ram type, and the one illustrated has inverted cylinders 8 in. diameter, with a 4 in. diameter of ram and 8 in. length of stroke. The pump barrels, valve boxes, and air vessels are cast together, so as to form a standard, spread out at the top and bottom to carry the cylinders and to form the crank shaft bearings. The pump barrels are placed over the crank shaft, which is connected to the rams by the forked connecting rods.

The pump mitre valves are of large area and are placed behind the barrels, at the side of the standard, communicating by large water passages with the air vessels, which are provided for both suction and delivery. The piston areas are reduced on the under side, in order to equalize the load during the suction stroke and to economize steam by means of the "trunks" cast on the pistons. The general design of this "Colonial" pump must be pronounced excellent, and, as it is constructed of extra strength to resist rough usage, and the wearing surfaces are of large area, it can be run at very high speeds without any danger of breakdowns. This class of pump is designed for pumping against a head of 400 ft., but, we understand, Tangyes Limited are also manufacturing pumps of the same design, of lighter construction, for boiler feeding and moderate lifts, and we shall not be surprised if the latter are adopted in large passenger steamers. Among the numerous exhibits of Tangyes Limited there was still a number we cannot pass over in silence. For shipbuilders and engineers there are various attractions in hydraulic and screw jacks of all sizes, while the latter have presented to their view a variety of tools, including a 10-inch screw, cutting lathe, a radial drilling machine, a very clever little milling machine, besides a lot of sundries, such as surface plates, screwing tackle, lifting tackle, sight-feed lubricators, &c. Amateur engineers should not overlook the two lathes specially designed and exhibited for their use; and we were particularly pleased with the hand-feed wood planer for patternmakers, and the Dimension Sawing Machine. The latter has two saws on one arm, one for cross-cutting and the other for ripping. This machine cuts so clean that the work can be put together direct from the saw without further treatment. The saws being on one arm, and attached to a simple arrangement of gearing, can be brought up to any height above the table, making it equivalent to a saw with rising and falling spindle. It is also fitted with a quadrant and scale for cutting angles, bevels, &c. The size of machine saw exhibited is largely used by marine engineering firms for pattern-making, being extremely useful and economical for half lapping and cutting lignum-vitæ mitres for stern bushes. Tangyes Limited as representatives of the Blackman Air Propeller Ventilation Company, Limited, 63, Fore Street, London, E.C., exhibited a trophy of air propellers, ranging from 14 in. to 72 in. diameter; also one 4 ft. in diameter, in a casing, driven by a 2½ H.P. Tangye gas engine. These Blackman fans, so largely used for ventilating purposes, need no commendation, being well and favourably known. A number of Gresham's automatic and other injectors were also among the multifarious exhibits of the enterprising and successful company of Tangyes Limited.

The Canada Works Engineering and Shipbuilding Company, Limited, of Birkenhead, was one of the few West coast firms represented at this exhibition. They exhibit a speciality, which we illustrate, viz., Edmiston's patent steam condenser, and feed water heater. Our illustration shows a sectional view through the centre of condenser, from which it will be seen the condenser consists of a number of hollow discs of copper, through which the steam is led from the top of the vessel, and as it is condensed, the water, aërated in its descent, falls into a charcoal filter through two outlets, from which it is drawn free from all impurities, a perforated plate inside the fresh water cock preventing any of the charcoal or other *debris* from choking the outlet. At one inside there is an inlet for the circulating water, and higher up on the other side a water escape valve, and at the top on the same side an outlet for the circulating water. The steam to be condensed is admitted at the top and passes down through the discs to the bottom. Evidently there is in this Edmiston's patent condenser proportionately large and effectual cooling surface, and it is claimed that in this respect it is the best condenser in the market. When fitted to the exhaust pipes of steam winches for condensing the waste steam, the condensers are entirely self-acting, and do not require any circulating pump. Condensers of this type may be expected to become much more common, on board even ordinary deadweight carrying mercantile steamers, as high pressure steam is more generally used. It is surprising to what an extent the loss of fresh water feed is allowed to go on in many vessels by the passing of the waste steam from winches, steering gears, &c., overboard, but every year we anticipate there will be an increased disposition to economy in this respect, especially as it frequently entails a large addition to the ordinary feed-water of the main boilers, and a consequently increased risk of salting up. A condenser of this type might also profitably be employed in distilling salt water for the purpose of supplying the losses, which render the filling up of the main boilers of a steamer necessary, where a passage occupies more than three or four days. The feed water so obtained could be of any desired temperature, and would promote economy in the coal consumption. The Edmiston patent condenser can be used as a surface condenser for launch, yacht, and torpedo boat engines, and it is particularly adapted as an ordinary fresh water condenser for



troop, passenger, and cattle steamers, sailing vessels, torpedo boats, yachts, and launches. The agent for the Edmiston patent condenser is Mr. J. H. Fenwick, A Exchange Buildings, Newcastle-on-Tyne.

Messrs. Donkin & Nichol, Engineers, of St. Andrew's Works, St. Andrew's Street, Newcastle-on-Tyne, had a well-arranged stand in the West Court, containing a number of the specialities they manufacture. The most important of these are Messrs. Donkin & Nichol's patent combined steam and hand steering gears, of which they exhibit three, all under steam. In fig. 1, we illustrate one of their midship steam and hand steering gears, of which large numbers are now in use. It will be seen the cylinders are placed vertically, the connecting rods through the cranks actuating a worm, and transmitting the power to the main shaft, on which through the pinion gear the power is transmitted to the steering chains. At the back of the gear is the patent valve, by which the engine is reversed and started instantaneously, on the small steering wheel being turned in the required direction. This small wheel is secured on an inner shaft, and the large wheel on a hollow shaft, enclosing the smaller one. In connection with the valve shafting, actuating the patent starting and reversing valve, there is usually attached, at the option of the purchaser, additional shafting leading up to the upper bridge. Among the exhibits on the stand was a very

handsome brass pillar standard, having an indicator showing the position of the rudder, and equipped with a brass mounted teak wheel, specially constructed for placing on an upper bridge, in connection with the steering gear illustrated in fig. 1. There is also on the front of the steering gear proper, driven off the shaft of the large pinion wheel by gearing, an indicator, showing the position of the rudder. The sizes of the engine cylinders of the midship gear exhibited, that we have now described, are 6 in. diameter, by 6 in. length of stroke, and the space occupied is only 3 ft. 6 in. fore and aft, and 3 ft. athwartships. Fig. 2 represents a modification of Messrs. Donkin & Nichol's patent midship combined steering and hand gear, in which greater power is obtained by the substitution of a worm and scroll wheel, in place of the pinion gear, without necessitating much increase in the space required. In fig. 3, we illustrate a vertical hand and steam aft steering gear, manufactured by Messrs. Donkin & Nichol, in which the arrangements of the steam gear are almost identical with that already described; the principal difference being the substitution of a powerful hand screw gear, actuating the ordinary cross-head fixed on the rudder head. The steam gearing may be operated either from the bridge amidships, where a pillar and hand-wheel are fitted, or aft by the small wheel on the apparatus. Hand steering is done aft only,

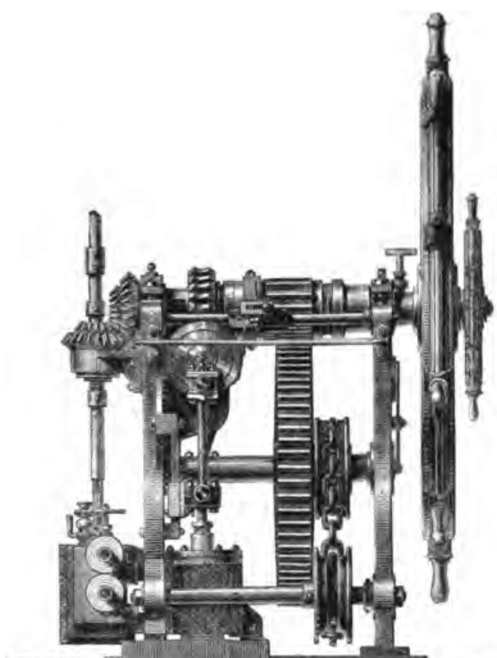


FIG. 1.

by the large wheel on the hollow shaft. The remaining steering gears that we have to describe, exhibited by Messsrs. Donkin and Nichol, have the steam cylinders fitted horizontally. Fig. 4 represents one of two horizontal hand and steam steering gears they exhibit. In it the hand and steam gear arrangements are distinct, and the greater space occupied allows of grooved chain drums being fitted instead of messenger sheaves and pitch chain. The working parts are also more accessible, and although there are two cylinders, 6 in. diameter, 6 in. length of stroke, the space occupied is only about 5 ft. fore and aft, and 4 ft. athwartships. The remaining horizontal steering gear, having cylinders 7½ in. diameter by 7½ in. stroke, we do not illustrate, has only one modification on the last-mentioned, viz., that in the hand gear a worm and scroll wheel is adopted. This arrangement is specially worthy of commendation, as it prevents the possibility in hand steering of men being thrown over the wheel by a heavy sea striking the rudder. In all their steam steering gears Messrs. Donkin & Nichol fit their patent valve gearing, which secures the most instantaneous action in steering; and in changing from steam to hand or from hand to steam steering the operation is instantaneously effected by the movement of one lever. The number of turns of the wheel in steam steering from "hard-over" to "hard-over" is usually the same in steam as in hand steering.

Messrs. Donkin & Nichol also exhibited a very successful ash-hoist engine, in which the automatic cut-off gear is on the same principle as on their steering gear engines. The steam supply and cut-off gear is so arranged that if the bucket is to be either raised or lowered, the machine can only be operated in the proper direction. In raising, the engine is automatically stopped when the bucket arrives at the opening in the ventilator above deck; in lowering, when the bucket reaches the stokehold floor. The ash-hoist engine exhibited is the usual size adopted, viz., 4½ in. diameter of cylinder, 6 in. stroke. Similar engines were fitted by the makers on board the belted cruisers *Orlando* and *Undaunted*, and the Austrian cruisers *Panther* and *Leopard*, as well as in many other Government and mercantile steamers. Mill's patent high-speed engine, with revolving cylinders, of very simple construction, suitable for driving dynamos, fans and steam launches, would not be over-

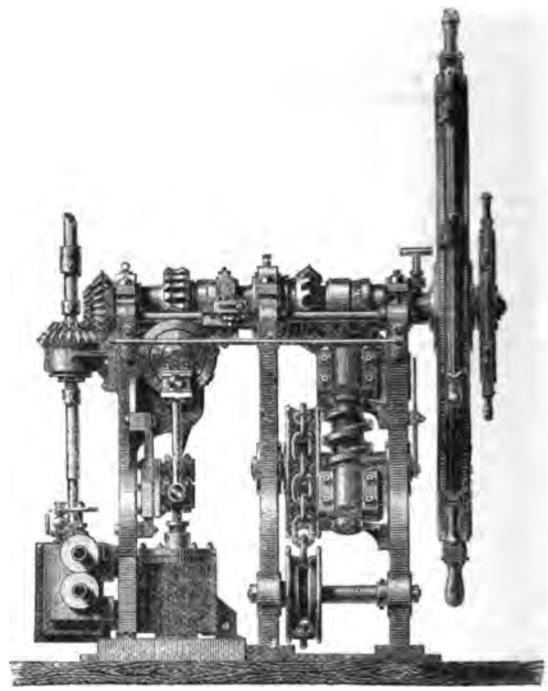


FIG. 2.

looked in paying a visit to the stand of the makers, Messrs. Donkin & Nichol, nor the specimens of improved engine-room and steering reply telegraphs. "Smith's" patent burner for liquid fuel is also an interesting exhibit. A neat arrangement of combined double fan and direct acting engine for forced draught was also exhibited, well worthy of attention, seeing how increasingly assisted combustion is coming into favour. The fan is 4 ft. diameter, having the engine bolted on the side of the case in such a manner that the width over all is only 2 ft. 10 in. There was also to be seen at Messrs. Donkin & Nichol's stand, plans of a marine boiler with four furnaces fitted up with Ferrando's system of forced draught, which has been now adopted in over one hundred steamers. It will be gathered from our brief description, that the exhibits of Messrs. Donkin & Nichol were of a specially practical and interesting character, and in each instance we are only stating the bare truth, when we remark that the workmanship and material leaves nothing to be desired.

SHIP VENTILATION.

There was amongst the exhibits applying to the ventilation of buildings, &c., several applicable to sailing ships and steamers. Prominent amongst the firms having a large collection of ventilating *apparati* we noticed that of Messrs. Robert Boyle & Son, Limited, Patentees, Manufacturers, and Sanitary Engineers, 64, Holborn Viaduct, London, E.C., 110, Bothwell Street, Glasgow, and 66, South Castle Street, Liverpool. The stand of Messrs. Boyle & Son would be readily found by the visitor as he left the North Court to enter the North Gardens, in the outside lean-to against the wall of the North Court; and an inspection

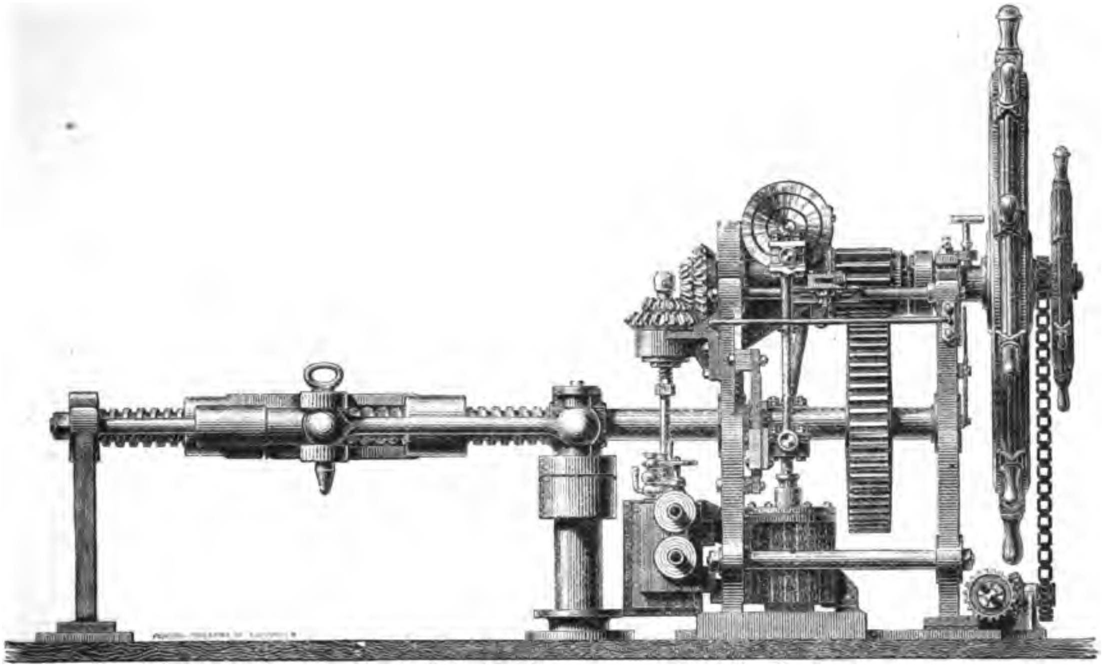


FIG. 3.

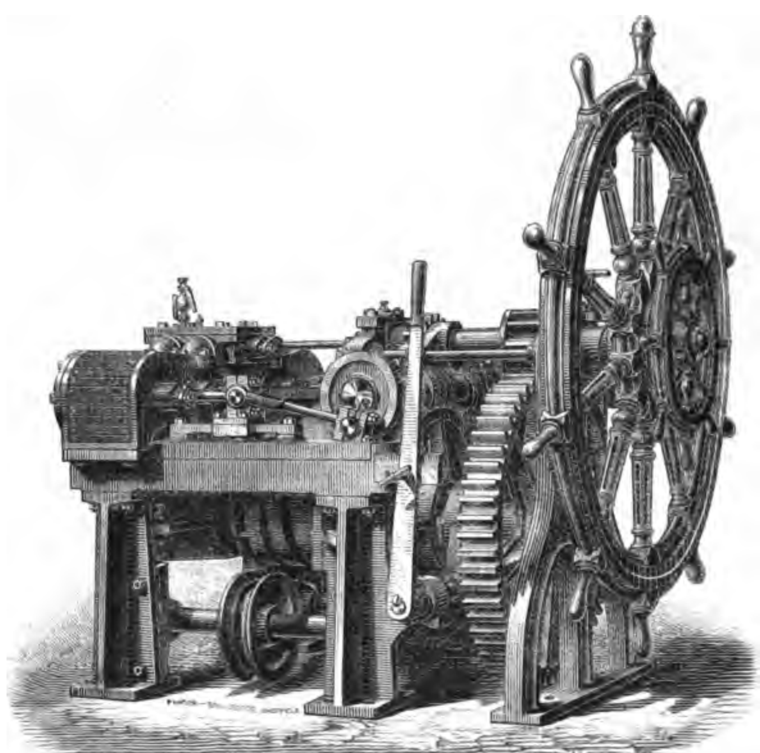


FIG. 4.

MESSRS. DONKIN & NICHOL. (For Description see page 267.)

of the various forms of cowl heads, prison, house, sewer, and other ventilating *minutæ* will not prove uninteresting. Specially attractive to many of our readers would be the exhibits illustrative of Messrs. Boyle & Son's system of ventilation for steam, sailing ships, and yachts, all in accordance with their latest improved form of ventilators, patented in 1882. This system may be briefly described as a combination of the air-pump upcast and downcast ventilators, which, in conjunction with an arrangement of pipes, creates a continuous and powerful current of fresh air between decks, whether the vessel is lying in a harbour or sailing on the ocean. In our illustration (fig. 1) we show a portion of the longitudinal section of a passenger steamship fitted up with Messrs. Boyle & Son's system of ventilation for ships, so arranged that all disagreeable draught is effectually avoided, whilst the foul air is entirely got rid of and its place supplied with fresh pure air. Examining our illustration already referred to, the ventilator or cowl heads marked A are the self-acting air pump upcasts, and the main extracting shafts connected to them are marked B. Branch piping led under the ceiling of the various 'tween decks, and through the various passenger compartments, are marked C, into which further branch pipes from state rooms, &c., are led. Small circles in the pipes marked D denote the position of the foul air exit openings into the system of piping which carries the foul air off in the upcast ventilators A. Partition plates are fitted as at E to prevent currents in branch pipes meeting and creating an eddy, and also to deflect the currents up the main shafts. The downcast ventilators are marked F; the main supply air pump leading from them, G; and the branch supply pipes to cabins, saloons, &c., H. Short vertical tubes marked J are fitted to admit the air in an upward direction and so avoid draughts, and these tubes are fitted with regulating valves, so that the air supply is completely under control. Both the main and branch extraction pipes and inlet pipes are usually concealed inside the wood lining, &c., so as not to interfere with the symmetry of the arrangements of saloons and state-rooms; and, if deemed advisable, small steam pipes may be placed inside the supply shafts and connected with the boilers for the purpose of warming the air in the cold weather, and similarly ice boxes can also be arranged in the shafts for cooling the air supply in summer. Seeing what a simple and effective system of ventilation is provided in this arrangement of Messrs. Boyle & Son, it is not surprising that it has been used by the British, French, Russian, Dutch, and other Governments in their vessels, as well as by all the leading British and Foreign steamship companies. This system still maintains its superiority over other patents, as will be seen from the fact that the late National Line steamer *America*, the latest Cunard liner *Umbria*, and the *Champagne*, *Britagne*, *Gascoyne*, and *Bourgoyne*, of the Compagnie Générale Transatlantique are fitted with it, and that within the last few weeks it has been adopted on board one of the new ships for the Danish Navy. In our next illustrations, fig. 1A, fig. 2, fig 3, we show detailed illustrations of the ventilators, which are usually about twice the diameter of their main supply or extracting pipes, and vary in sizes from 8 in. to 36 in. in diameter, although in mercantile vessels the diameters usually range from 16 in. upwards, the smaller sizes being specially intended for yachts. Fig. 1A shows the elevation of an upcast ventilator for fixing on deck. This air-pump exhaust ventilator of the latest improved form creates a continuous and powerful up-current, and is entirely free from down draught, so that it is never liable to be non-effective, as is often the case in other ventilators. A point greatly in its favour is that it is perfectly watertight, and may thus be kept in action during the stormiest weather, even though seas be washing over it, but doubtless it is absolutely essential for the shipbuilder to provide coamings of sufficient strength, and so efficiently connected to the weather deck that they cannot be carried away. Other points of excellency in this up-cast ventilator is that it does not require to have its head moved; it acts with equal efficiency from whatever point the wind may be blowing, and owing to there being no mechanical movement it cannot get out of order. Fig. 2 shows a sectional view of the same up-cast ventilator, of the form made for fixing on the roof of a deck house, and with the description already given of fig. 1A no further remarks are necessary to elucidate the operation of this ventilator. In Fig. 3 we have an external view (elevation) of a down-cast ventilator of the latest improved form. Similarly to the upcast ventilator, this one is also watertight in the worst of weather, and never requires trimming. This last-mentioned feature is unmistakably a great advantage, and it is surprising that on account of it alone every large mail and passenger steamship has not been fitted with Messrs. Boyle & Son's patents. Those marine superintendents and naval architects who have not hitherto given these ventilators a trial, when they remember the troubles that have beset them in obtaining a sufficient and at no times excessive or deficient air-supply, would, we feel assured, be gratified by the results obtainable from the complete arrangement as shown in our first illustration of this system. The ventilators just described are made in galvanized iron, brass, or copper, as may be desired by the purchaser, and are manufactured *solely* by Messrs. Robert Boyle & Son, Limited.

Adjoining the stand of the last mentioned was that of the Eon Ventilating Company, of Byron Street, Newcastle-on Tyne, but their exhibits relate entirely to the ventilation of buildings, &c.

PROTECTING IRON AND STEEL SHIPS' PLATES AGAINST RUST.

WE have recently had our attention drawn to the results of some experiments made by Messrs. M. Holzapfel & Co., of Newcastle-on-Tyne, with a view to preventing the falling off of paint and compositions from new iron, and particularly steel ships' plates, and as these experiments have been highly successful we have much pleasure in bringing them under the notice of our readers.

It is well known that this long-standing evil of paint and composition peeling off has more particularly manifested itself of late in consequence of the substitution of steel for iron plates, all new vessels invariably throwing off their first coat. This may in part be attributed to the smooth surface of the plates and in part to the existence of a "bloom" on their surface, which after a short time detaches itself and falls off, carrying the paint with it, and so exposing large portions of the plates to the deleterious action of the salt water. This is aided by the continuous chafing between wind and water caused by lighters and quay walls, and in the bows by the anchor chains, whereby large surfaces of paint are removed and much rusting results.

The Admiralty and a few private shipowning firms have attempted to overcome this lack of adhesion between plate and paint by pickling the plates in a weak solution of hydrochloric acid before rivetting them on the frames, thus removing the "bloom" and producing a slightly porous surface on which the paint can get a readier hold. This process, in addition to its expense, requires very careful handling, as an appreciable amount of metal is lost if the plates remain too long in the acid, while even under most favourable conditions the surface produced is not sufficiently rough to secure the adhesion of the paint when subjected to outside chafing. It has been reserved to Messrs. Holzapfel & Co. to devise a thoroughly practical, and at the same time simple and inexpensive, method of surmounting this difficulty, their plan consisting in simply *rough rolling* all the plates to be used in the construction of a vessel. This is done at the rolling mills, where the rolls, instead of having smooth cylindrical surfaces, are formed so that their rolling faces somewhat resemble a fine file, corresponding indentations being of course formed in the plates as they pass between them.

Judging from their long experience and careful study of the whole subject Messrs. Holzapfel inform us that they are confident, after a few careful trials have been made, that this method will be speedily adopted; and having regard to the great benefits that would accrue from the adoption of so simple a remedy, we can only express a hope that their prediction may soon be verified.

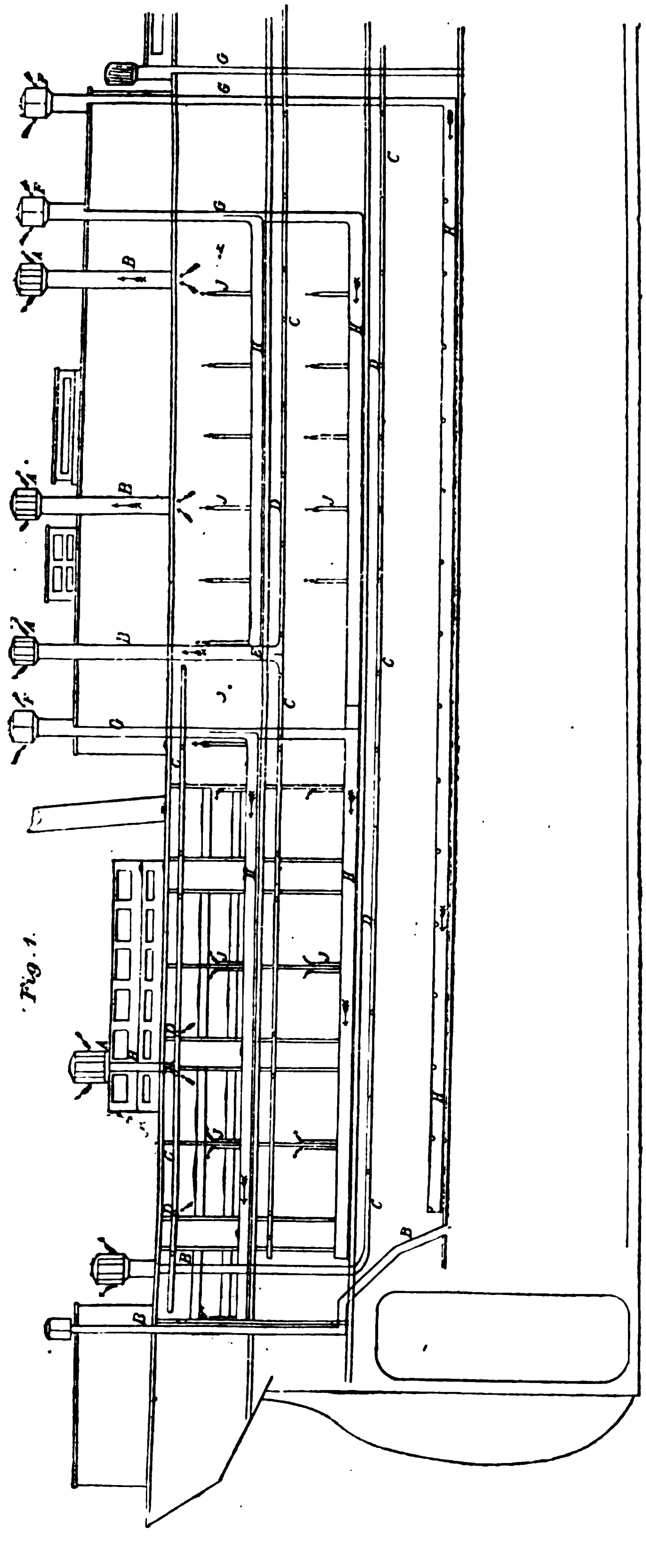


Fig. 1.

Fig. 1a.

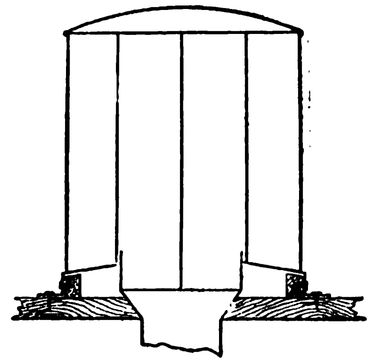


Fig. 2.

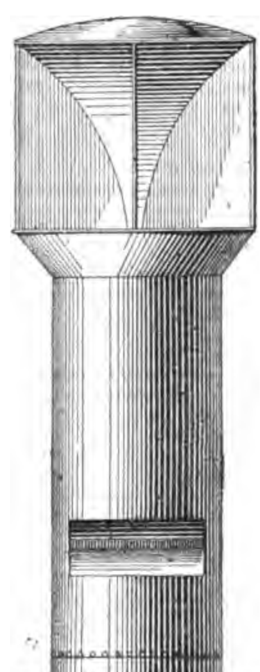


Fig. 3.

MESSRS. ROBERT BOYLE & SONS. (For Description see page 270.)

It is evident that by having the surface of the iron roughened in this manner the minimum of scale would be formed, while the paint, which could be applied at once, would find a suitable surface for permanent adhesion. Again, when chafed the injury would be localized by the roughening, and only a very small quantity of paint being displaced the consequent rusting would be insignificant. Finally, it should be pointed out that the roughness of the surface would not affect the ship's speed, as when covered with a few coats of paint an outer surface, equal to that obtained when using smooth rolled plates, would be produced.

Messrs. Holzapfel will supply any further information on this important subject on application to any of their addresses.

NAVAL ENGINEERS.

In no branch of the navy has such gigantic strides been made in the last twenty years as in the engineer department. Previous to 1863 the scientific officers were mostly recruited from the leading engineering firms of the day; but to ensure always having an available staff in case of emergency, specially trained to the particular requirements of war-ship machinery, the Admiralty instituted the system of training their own officers in the royal dockyards. Engineer students were apprenticed for six years either at Chatham, Devonport, Portsmouth, Sheerness, or Woolwich, during which time they received a practical insight into all the trades connected with engine construction, as well as being instructed in the duties that naval engineers had then to perform. Yearly examinations were held, and the students who best distinguished themselves were sent to the Royal School of Naval Architecture for a course of study in the higher mathematics and in the theory of marine engineering. In 1878 a modification took place in the system of training the students. Instead of being spread over all the dockyards, Portsmouth and Devonport were selected as the seats of learning for the future naval officers; and with this change came also the adoption of a naval uniform for the students, and the establishment of H.M.S. *Marlborough* at Portsmouth, and the Keyham College at Devonport as training schools, in which the students were to reside and to be subject, under the supervision of naval officers, to the discipline which is so essential in the training of those who are to hold positions of importance, and who will be placed in charge of large numbers of men, amongst whom discipline must be maintained. Before 1873 the examination for entry into the dockyards as an engineer student was an open competitive one, there being no restrictions as to the number or social positions of the candidates. With this system the competition was very keen, there being often from fifteen to twenty times the number of candidates that there were vacancies to be filled. For many years previously the engineers of the navy had been smarting under a considerable number of grievances, which arose out of the fact that while they were accorded commissions and rank the same as the officers of other branches in the navy, they did not always receive the rights and privileges due to such rank.

By acting in concert and bringing great pressure to bear on the authorities at the Admiralty, a committee, with Admiral Sir Cooper Key as president, was appointed to enquire into the position, &c., of the naval engineers. One outcome of this committee was the institution of nominations for engineer students, by which the Admiralty limit the competition to about five times the number of candidates that there are vacancies. With the adoption of the training schools, and the extra expense incurred in providing the uniform and other necessaries for students, in addition to a yearly payment towards the maintenance of the student at the school, a method of selection was thus carried out, for none but those whose parents or guardians could afford the cost of training—and which on reliable authority is stated to be between £70 and £80 per annum—were allowed nominations. Formerly the examinations were confined to the naval ports, but under the present system they are held in all the principal cities of the United Kingdom. During the last 15 years great changes have been made for the better in the rank and position of the engineer officers, although in the junior ranks the pay is even now inferior, age for age, to what it was some 30 years ago. One great stumbling block to the advancement and comfort of these officers for many years was the separate mess that they had to keep on every ship, which meant isolation from all the other officers; but a few months ago the last engineers' messes were abolished. Those in the royal yachts being the last to succumb to the inevitable; and now the engineer, of whatever rank he may be, takes his place and on the same footing with the other officers of the ship of corresponding rank. Although Sir Cooper Key's Committee made their report in 1873, many of its recommendations have not as yet been adopted. The chief amongst these is the making the engineer branch of the navy an executive department instead of a civil one.

All the officers and men in the navy belong to one of two classes—combatant or non-combatant, executive or civilian. How the distinction ever arose is a difficult mystery to solve, for in a ship in action, above all places in the world, every man and officer runs the same risks, and fights in one way or another. Be that as it may, the duties of the modern naval engineer officer necessitate his being as much a fighting officer as any one in the navy. In modern ships of war, in which the engineering staff form about one-third of the entire crew, it seems absurd to think that the chief engineer has practically little or no control over his men, but has in all matters relating to his men and the machinery, &c., in his charge, to refer to an executive officer, often junior in rank to himself, and invariably younger, and who generally has little or no experience in the question to be settled. Considering that the present naval engineer is one of the best and most scientifically educated officers in the navy (as a comparison of the courses of study for the various kinds of officers shows), and also from the fact that nine-tenths of the engineer's duties bear more directly on the way in which a naval action will in future be fought than does the duties of any other officer, it passes all comprehension why the Admiralty oppose so strenuously what has been considered for the past fifteen years to be necessary for the service, and which is bound to follow before very long.

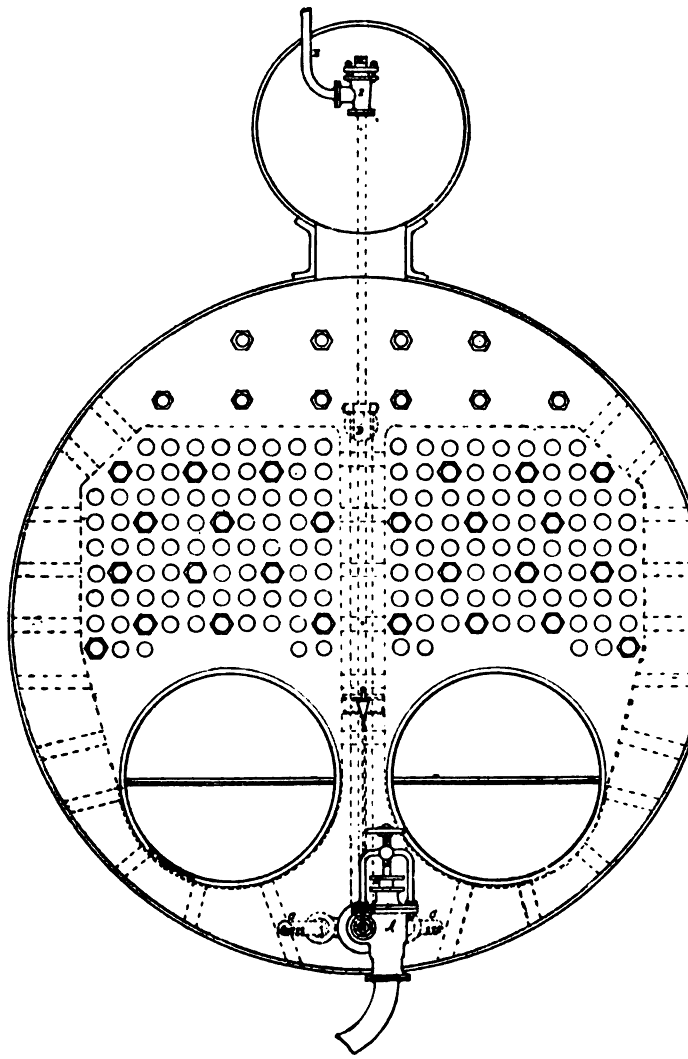
The new Peninsular and Oriental Steamship *Victoria* has made the passage between Plymouth and Gibraltar in sixty-nine hours.

The yachtsmen of Halifax, Nova Scotia, have decided to build a boat, to compete for the American Cup next year.

THOMSON'S PATENT FEED WATER HEATER AND CIRCULATOR.

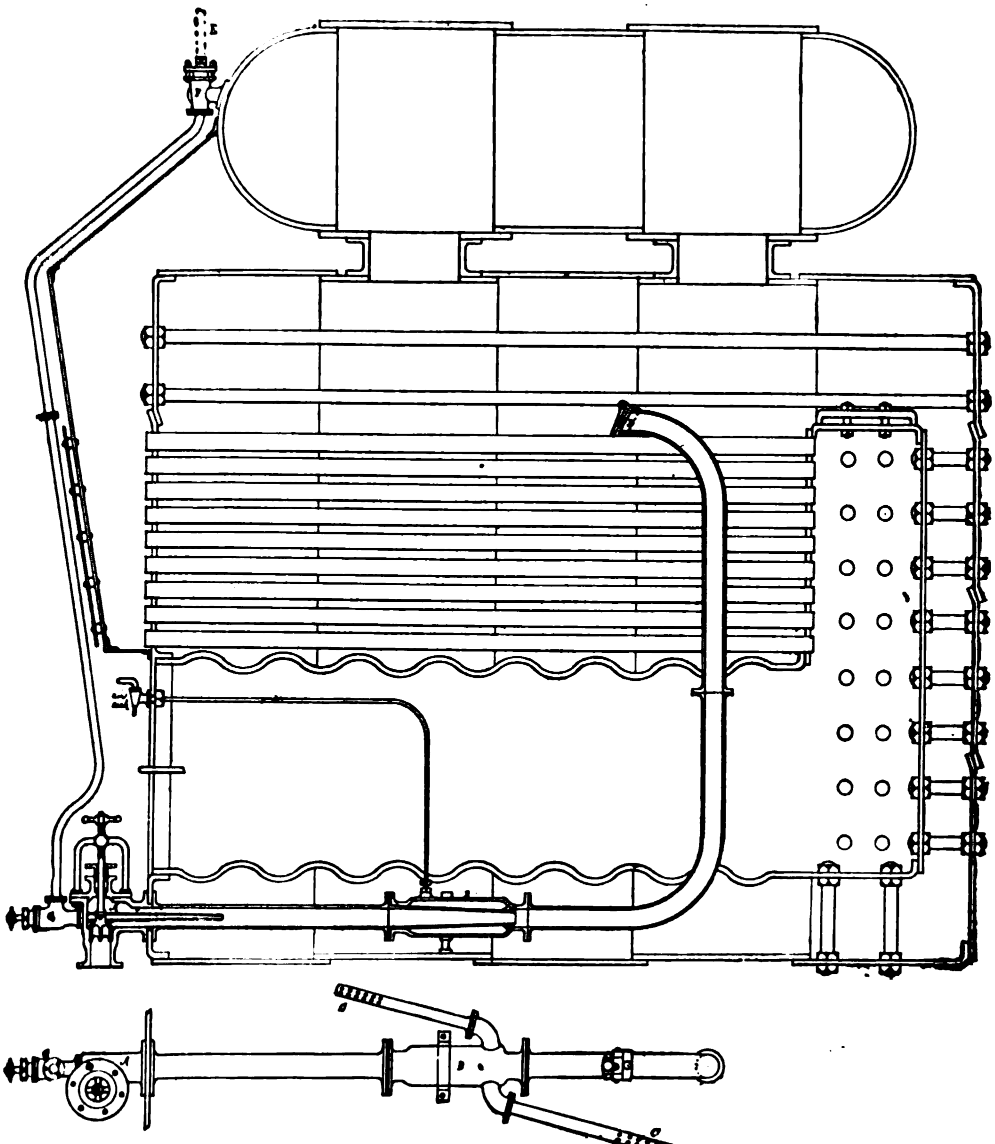
THIS is the invention of a competent marine engineer, and fitted to the new boilers of the *John Pender*, of the Eastern Telegraph Company, Limited, it is giving unqualified satisfaction. Mr. H. P. Sherlock, the chief engineer of the ship, certifies to trials of temperatures from the donkey boiler and the steam circulator in the starboard and port boilers. The starboard trial was made on the 31st March, and the port boiler trial on the 5th April of the present year, the coal consumed on each occasion being 1½ cwt. per hour. As there was some difference in the results, the conditions being the same, it will be better to particularize them than to enter upon ingenious speculations, premising this much, that the general result was highly commendatory of the invention as an addition to the boiler fittings of sea-going ships. Taking first the starboard boiler trial, at 10 a.m. there was 40 lbs. of steam on the donkey boiler, and the water temperatures at the starboard boiler bottom and at the breast cock were 48°. An hour later, with no change of pressure on the donkey boiler, the water temperature at the starboard boiler bottom stood at 81°, and at the breast cock at 82°. Passing by the register of the intermediate hours next at 3 p.m., with no change of pressure on the donkey boiler, the water temperature at the starboard boiler bottom stood at 166°, and at the breast cock at 168°. An hour later, namely at 4 p.m., the bottom temperature was 187°, and the breast cock temperature 190°.

Taking now the port boiler trial, with throughout the same pressure of 40 lbs. on the donkey boiler, we have at 10 a.m., the water temperature at the bottom of the port boiler at 48°, and at the breast cock at 48°. An hour later, the water temperature at the bottom of the port boiler was 81°, and at the breast cock 80°. Again passing by the register of the intermediate hours next at 3 p.m., the temperature at the bottom of the port boiler was 153°, and at the breast cock 157°. An hour later, namely, at 4 p.m., the bottom temperature was 169°, and the breast cock temperature 174°. The difference as between the starboard and the port boilers is a fact, and this also is a fact, that the feed water heater and circulator practically established identical temperatures at the boiler bottom and at the breast cock, thereby getting rid of the destructive boiler plate strain, incident to two distinct water temperatures on the same surface at the same time.



A further trial was made by Mr. Sherlock on the 26th

of April of the present year under these conditions: The port boiler, with 13 tons of water, had its fires lighted when 40 lbs. of steam pressure had been put upon the donkey boiler, and with the light up the steam circulator was set in motion. But Mr. Sherlock may as well say what was done. He says: "We lit the fires in the main boiler, at the same time turning on the steam from the donkey boiler through the small valve on the check chest. The temperature of the water was maintained equally throughout the boiler, and steam began to rise within



THOMSON'S PATENT FEED WATER HEATER AND CIRCULATOR.

two hours, without in any way forcing the fires, while in two hours from the time we first lit up, the pressure of steam was 8 lbs., the temperature of the water at the bottom of the boiler being 212°. This conclusive evidence was quite sufficient to assure me that the apparatus is a necessary fitting to any boiler for equalizing the temperature before attaining any great pressure, and I wish it all the success it deserves." At 10.25 a.m. the port boiler fires were lighted, and at 10.30 a.m. the water temperature at the boiler bottom was 50°; at 11 a.m. it had increased to 86°; at 11.30 a.m. it had increased to 124°; at 12 it had increased to 174°; at 12.30 it had increased to 212°, with 8 lbs. pressure on the boiler; and at 1 p.m. it stood with 50 lbs. pressure on the boiler. Through the profession of Marine Engineering this will be generally recognized as a marked and satisfactory advance in steam raising, and also as a highly preservative advance in the duration of steam boilers. With increasing steam pressures upon boilers, nothing is conceivably more desirable towards their endurance, to say nothing of their safety, than that they should be subject to an equal steady strain, and the accomplishment of this is the sum and substance of the simple, inexpensive and efficient invention of Marine Engineer Thomson. To the profession it will be a satisfaction that the invention is not that of the outsider class who are always asserting that improvement comes from them.

The first illustration is an end view of a steam boiler

fitted with Thomson's patent feed water heater and circulator. The central tubes are fire tubes, and above them are the boiler stays.

The second illustration gives the fittings in detail. Keeping in view the fact that equality of water temperature can only be maintained by adequate top and bottom water intermingling, an examination of the drawing will show how this is provided for. The apparatus is mechanical, and it works automatically, the feed water from the main feed pumps necessarily displacing from the bottom of the boiler as much stagnant water as each stroke of the pump delivers. This obviously dispenses with the ingenious zinc plate arrangements, and also with the use of the even more ingenious boiler compound; and while preventing boiler pitting, it has the further advantage of forcing to the scum cock such saline matter as may be present in the water. Of course, these advantages will not be at once recognized and become matter of adoption, but there they are ready to the hand. Before long they cannot fail to command universal appreciation.

A is a feed check valve chest, with main feed pipe attached. From this a delivery pipe inside the boiler leads to a suction chamber B, which has two branches, C C, perforated at the ends. These branches lead from the bottom of the boiler, and through them a portion of the water from the bottom is carried to the delivery valve D, near the surface. At the surface there is thus maintained a constant co-mingling of the bottom and top water, with perfect equalization between bottom and top temperatures. E is a steam pipe leading to stop valve on donkey boiler, and F is a cock on main boiler or on superheater, as the case may be; and from these connections a pipe leads to a valve G, on the feed check valve chest A.

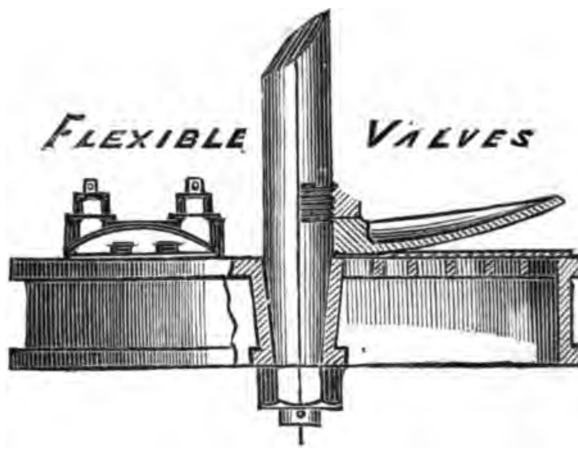
Before lighting fires on the main boilers, steam is admitted through the steam pipe E, which leads from the stop valve on the donkey boiler, through the valve G, into the internal feed pipe. This circulates the water from the bottom to the top, and heats the water equally throughout the boiler. When steam has been raised, and the feed pumps are at work, the cock F is used to heat the water; and the steam used in this way is small and costless, and at once repaid by diminished coal consumption. Finally, by scumming the saline matter forced to the surface, the cylinders and valves are all the time supplied with clean steam, to an all-round saving from wear and tear. Moreover, the condenser is kept free from accumulation, fuel is saved, and generally highly satisfactory working conditions are secured. This system of circulating feed can be arranged to suit the check valve feed on boilers.

THE EXPLOSION ON BOARD THE ELBE.—The adjourned inquiry into the cause of the bursting of the main steampipe on board the Royal Mail steamer *Elbe*, on the 19th ult., by which ten persons lost their lives, was recently resumed and concluded at the Southampton Town-hall. The borough coroner, Mr. Coxwell, and Messrs. Samson & Woodthorpe, Board of Trade assessors, conducted the inquiry, as on the former occasions. The evidence taken was purely technical, describing in detail the elaborate tests which had been made on 62 specimens of the copper cut from different parts of the steampipe. The results showed the metal to have been uninjured by the brazing, that there was nothing abnormal about the copper, and that it was not of inferior quality. The jury ultimately returned a verdict of "Accidental Death."

KINGHORN'S PATENT METALLIC VALVES.

THE accompanying illustrations represent, typically, these well-known metallic valves as applied to air, feed, bilge and other pumps. Figs. 1 and 2 show respectively an air pump bucket in elevation and in plan, in both cases partly sectional, while Figs. 3 and 4 give, also in elevation and plan, an arrangement for mu tiple disc valves, these latter views being also partly sectional. The illustrations are self-explanatory and it needs there-

FIG. 1.



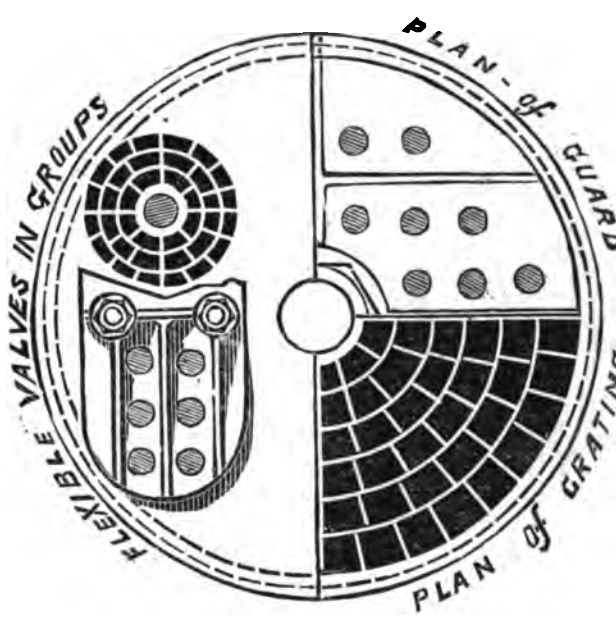


FIG. 2.

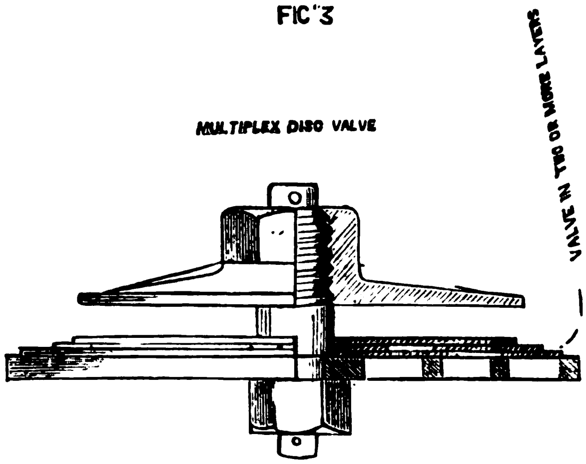
fore only to be said that the valves are made of incorrodible, wear-resisting metal, fitted in layers or discs, as shown, each layer being free to move on the central stud independently of the others. The bottom and intermediate layers may be perforated with a number of holes, these being so disposed as to allow no passage when the layers or discs are close together. As the valve opens, the layers open simultaneously or independently, lifting on the central stud and allowing particles of air or water to

pass in between them, which considerably lessens the sound of impact, and also the strain thrown on the valves and studs. The holes in the discs facilitate the entrance of the air and moisture between them, and also act as passages for the air or water to pass through, providing a greater area without lifting the valve so far off its seat, as is the case with ordinary dead-lift valves.

Should a quick-closing action be required, a spiral or other spring is fitted to the central stud, which, acting on the top layer, forces it back to its seat as soon as the pressure on the other side is removed. A guard, placed on central spindle, as shown in Fig. 3, regulates the lift of the valve. The grids or seats are constructed with bars

FIG 3

MULTIPLEX DISC VALVE



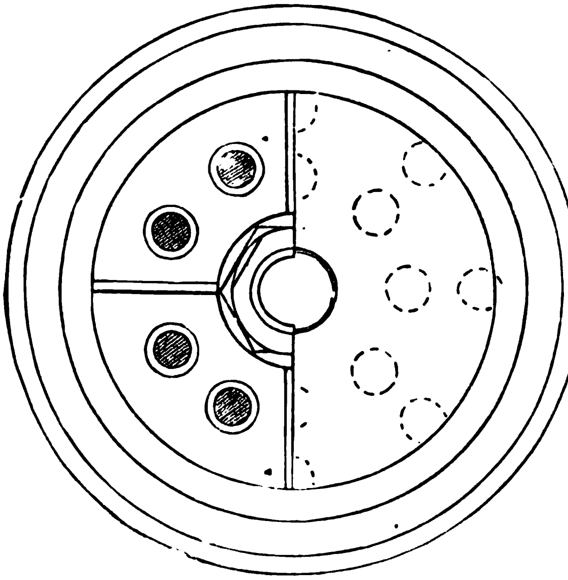


FIG 4

or openings of the usual form. For valves of small diameter, say up to 10 in., the multiplex discs are very economical, durable and efficient, and can be applied to existing grids and studs.

From a list giving particulars of the valves as fitted to 25 vessels, the names of which were selected promiscuously from 800 steamers so fitted, we find the average cost for maintenance for twelve months was only £1 3s. 7d. per vessel, a fact which speaks volumes for the durability of these valves.

The makers, The Metallic Valve Co., of 69, Tower Buildings, Water Street, Liverpool, have supplied the valves, amongst others, to the following: The Admiralty, Austrian Lloyd's, Allan Bros., British India Co., P. and O. Co., White Star Co., Inman s.s. Co., Guion & Co., Donald Currie & Co., National, and Clan Lines, &c., &c. The valves are also used in the works of Caird & Co., Earle's Shipbuilding Co., Laird Brothers, Maudsley & Co., Palmer's Shipbuilding Co., John & James Thomson, and many other eminent firms.

We should mention that with these valves feed water of any temperature may be used, while being impervious to the action of oils or other lubricants they can be used for long periods in situations where rubber valves would be soon rendered inoperative; in fact, valves have been taken out after 80,000 miles steaming which were in every respect practically equal to new. The valve is meeting with a daily increasing demand, a sure proof that it is the right thing in the right place.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from September 26th to October 22nd:—

Agnew, Thomas, engineer to the *Stork*.
Anderson, A. R., assistant engineer to the *Audacious*, additional, to date September 27th.
Ball, Ralph H. C., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Barber, James, engineer to the *Agamemnon*, recommissioned, to date November 14th.
Barry, J. H. D., assistant engineer to the *Bellerophon*, additional, for disposal to date October 18th.
Bearblock, W. J., assistant engineer to the *President*, additional, for study at the Royal Naval College, to date Sept. 30th.
Bishop, Thos. H. B., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Blake, Albert S., engineer to the *Inflexible*.
Bolt, Charles W., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Bond, Edmund E., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Bray, Wm. T., chief engineer to the *Excellent*, additional, to date October 1st.
Collins, Charles H., assistant engineer to the *Agamemnon*, recommissioned, to date November 14th.
Crook, Geo. H., engineer, to the *Linnet*, to date September 27th.
Crowley, Edwd. A. E., assistant engineer to the *Audacious*, additional, to date September 27th.
Crisp, Arthur S., assistant engineer to the *Agamemnon*, recommissioned, to date November 14th.
Dart, F. H., assistant engineer to the *Asia*, additional.
Davis, Wm. A. J., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Dawson, Fredk. G., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Edwards, Walter, acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Eldred, Charles E., assistant engineer to the *Audacious*, additional, to date September 27th.
Emdin, Arthur R., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Fincham, Wm. C., engineer to the *Canada*, to date October 17th.
Fleetwood, John L., assistant engineer to the *Agamemnon*, recommissioned, to date November 14th.
Galpin, Joseph R., engineer to the *Mercury*, to date Sept. 26th.
Granville, Wm., assistant engineer to the *Agamemnon*, recommissioned, to date November 14th.
Haddock, Sidney G., assistant engineer to the *Curacoa*, to date September 28th.
Hall, Robt., staff engineer to the *Agamemnon*, recommissioned, to date November 14th.

Hardcastle, C. S., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Hart, Alfred, assistant engineer to the *Rodney*, to date Oct. 21st.
Hicks, John A. H., engineer to the *Téméraire*, recommissioned, to date October 20th.
Hill, Charles H., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Jenkin, John H., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Jennings, Robt. S., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Jones, Richard W., assistant engineer to the *Anson*.
Kent, Walter J., assistant engineer to the *Bellerophon*, additional, for disposal to date October 18th.
Laughrin, Henry, staff engineer to the *Conqueror*, to date October 17th.
Lecky, Charles B., assistant engineer to the *Myrmidon*, recommissioned, to date November 1st.
Lister, Francis H., assistant engineer to the *President*, additional, for study at the Royal Naval College, to date September 30th.
Liversidge, Edward W., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Liversidge, John G., assistant engineer to the *President*, additional, for study at the Royal Naval College, to date September 30th.
Meiklejohn, H. J., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Metcalf, Henry W., assistant engineer to the *Audacious*, additional, for disposal to date October 18th.
Moore, Charles A., assistant engineer to the *Téméraire*, recommissioned, to date October 20th.
Morpey, W. H., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Morris, Thos. A., chief engineer to the *Lily*.
Morris, Thos. E., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Murray, D. D., engineer to the *Ajax*, to date November 14th.
Olive, Wm., staff engineer to the *Téméraire*, recommissioned, October 20th.
Parsons, W. G., chief engineer to the *Excellent*, additional, for torpedo and hydraulic instruction, to date October 1st.
Parsons, W. G., chief engineer to the *Ready*, additional, and for appointment when recommissioned, to date November 1st.
Parrott, Jas. W. A., assistant engineer to the *Téméraire*, recommissioned, to date October 20th.
Pattison, Alfred R., assistant engineer to the *Téméraire*, recommissioned, to date October 20th.
Pounds, Thos. H., assistant engineer to the *Bacchante*, additional, for disposal to date October 18th.
Rees, John S., engineer to the *Myrmidon*, to date November 1st.
Roome, Geo. W., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Ryder, John F., chief engineer to the *Excellent*, additional, to date October 1st.
Salmon, Charles, staff engineer to the *Warrior*, to date Oct. 22nd.
Smith, Alex. G., chief engineer to the *Excellent*, additional, to date October 1st.
Snook, Victor E., assistant engineer to the *Audacious*, additional, for disposal, to date October 18th.
Sparkes, Henry P., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Taylor, Ernest J., engineer to the *Hercules*, to date Nov 14th.
Thompson, F. D., assistant engineer to the *Bacchante*, additional, for disposal, to date October 18th.
Thornhill, Ernest C., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Toop, Henry, acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Vaughan, John A., acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Wall, Lewis, acting assistant engineer, additional, for study at the Royal Naval College, to date September 30th.
Watkins, Benjamin J., assistant engineer to the *Northumberland*.
Whittaker, Frederick J., staff engineer to the *Impérieuse*, to date October 22nd.
Widdecombe, Robert C., fleet engineer to the *Prince Albert*, to date September 11th.
Williams, Walter H., assistant engineer to the *President*, additional for study at the Royal Naval College, to date September 30th.
Wishart, William L., chief engineer to the *Indus*, additional as admiralty overseer on the Clyde, to date September 21st.

SOUTH WALES TRADE NOTES.

Cardiff.—During the past month the staple trade in this district has been moderately brisk, the shipments of steam coal from Cardiff averaging from 140,000 to 150,000 tons per week. Prices have undergone no change since my last report. The best qualities are quoted at 8s. 3d. to 8s. 6d., and although some owners are disposed to do business at a point or two below the normal quotations, the market for this class of coal is now very firm, and before long prices will have an upward tendency. Second quality Monmouthshire coals have been in very moderate request, with no alteration in the quotations. In the early part of the month small steam was very plentiful, and as the patent fuel trade has been very depressed for a couple of months past, there was little demand for this commodity, with the result that quotations fell so low as 3s. 3d. per ton, a price almost without parallel for some years past. This week, however, there has been a slight upward move, and fair small is now selling at 3s. 9d. to 4s. Patent fuel is still in very poor demand; one or two fair orders have been booked by Swansea makers, but not sufficient to alter the present unsatisfactory state of things. The shipments in the other Welsh ports during the past month have been less than half during the corresponding period last year. Bituminous small coal has been very scarce, and for Rhondda No. 3, 5s. 9d. has been asked and obtained. The house-coal trade is steadily but slowly improving, the fine weather which has prevailed during the past month has militated against anything like a great demand, but orders are now coming into the market, and as a consequence owners refuse to book at current rate the orders for forward delivery. 8s. to 8s. 3d. for Rhondda No. 3 is the price demanded, and below this few sellers care to do business. In consequence of scarcity of pitwood at the wharves, and the paucity of arrivals from Bordeaux, pitwood has been very firm throughout the month, the demand increasing day by day, due, of course, to the fact that colliery owners are laying in their winter stock of wood. The latest market values are 15s. 9d. to 16s. according to qualities. Welsh cokes are also in improving demand, 14s. to 16s. being the present market value according to quality. It is expected that as soon as an upward move takes place in the manufactured iron trade these prices will be considerably improved. In the iron trade there is practically no change, local works are well employed, and for all manufactured qualities of iron and steel, the market rules very firm.

Quick Despatch.—The screw steamer *Bosphorous*, of Newcastle, arrived in the Bute East Basin, Cardiff, on Monday, the 18th inst. She was placed in the Junction Dry Dock adjoining, and underwent No 1 Lloyd's survey. She then proceeded to the Roath Basin, where she loaded a cargo of 3,000 tons of coal for Genoa, and left by the early morning tide on Saturday, the 22nd inst. This is considered the quickest despatch that has ever been done in the port. The work was done under the personal supervision of Mr. R. Williams, the inspecting engineer for the owners, and Captain Lowrie.

Proposed New Import Dock for Cardiff.—The necessary works preparatory to the construction of a new import dock between Grangetown and Penarth are being rapidly pushed forward. A portion of the foreshore on the west side of the river Taff, which it was found necessary to acquire for the purpose of the undertaking, has been conveyed by the Board of Trade to Lord Windsor, the owner of the adjoining land. Trial holes are being sunk, requisite plans and sections for the execution of the works are being prepared, and operations will, we understand, shortly be commenced. The new dock will be situated between the Windsor Slipway Company's Works and the Ferry Road at Grangetown. Its water area will be eighteen acres, while contiguous to it will be a timber pond of six-and-a-half acres. Land has already been provisionally let for the erection of manufactories, &c.. on the wharves.

Quick Despatch at Cardiff.—The screw steamer, *Shagbrook*, of London—Captain Ebbett—docked in the Roath Basin at 7 o'clock, on Saturday, the 15th instant, got under the patent movable tip at 7.30, and finished loading within a few minutes of midnight, having taken in 1,489 tons cargo and 87 tons bunkers in the remarkably short time of four and a half hours, including all stoppages. Messrs. Harris & Dixon, London, are the owners.

The screw steamer *Exe*—Captain J. K. Clark—belonging to the Mercantile Steamship Company Limited, London (Mr. James Buchanan, secretary), which left Penarth on the 15th inst., with a cargo of coal for Alexandria, is a new vessel built of steel, with a cargo-carrying capacity of 3,220 tons, by Messrs. J. L. Thompson & Sons, of Sunderland. Her engines are on

the triple-expansion principle, 23½ in., 35½ in., and 58½ in., with 39 in. stroke, with an I.H.P. of 1,000, by the eminent firm of Messrs. Blair & Co., Limited, Stockton. She is now on her second trip to the East. The results of her first voyage are, that the average consumption of Welsh coal was 9 tons per day, with an average speed of 10½ knots. On Monday, the 3rd inst., over 15,000 tons of coal were shipped at Penarth dock, this representing the largest shipment in one day since the dock has been opened.

Newport.—There has been a marked improvement in the trade of this port during the latter half of the month, and as the tonnage in the docks is moderately plentiful there is every prospect that the improvement will continue. The freight market is firmer, there is plenty of demand for tonnage, although owners are rather chary of fixing at present rates. Sail.—West India rates are firm, whilst quotations for the Brazils have an improved tendency. For the Mediterranean this class of tonnage is only in limited request, and rates are easy. Coastwise quotations are improving, though low. Steam coal is firm, and collieries are in most cases well stemmed for vessels ready, or due to arrive. House coal is also in better request at former prices. Iron shipments are not so brisk the latter part of the month as they were; latterly there have only been small shipments of a little over 2,000 tons to the United States, and about 600 to the Welsh Colony in Patagonia. The prospect for the coming winter as far as work is concerned is more encouraging, but competition with other countries compels iron masters to cut so fine that the possibility of even a moderate profit depends upon all things going easy. Latest prices for iron ore, Bilbao qualities, range from 12s. to 12s. 3d., pitwood from 15s. 6d. to 15s. 9d.

New Dry Dock for Newport.—Messrs. Mordey & Carney, dry dock proprietors and shipbuilders, of Newport, have decided to build a new dry dock 340 ft. in length on a triangle of the river on a site which was formerly a shipbuilding yard and more latterly the timber yard of Messrs. T. B. & S. Batchelor.

On Friday the 7th inst. the new patent blast furnace, which has been in course of erection at Blaina by the Pyle Furnace Company, was blown in and commenced operations. The furnace is especially built for the manufacture of spiegeleisin and ferro-manganese.

Swansea.—During the latter half of the month the shipping trade has been quiet, shippers have been badly supplied with tonnage, and the export of coal and fuel have been below the average. The demand for tin plate is dull, and there is no improvement in prices. Block tin has reached £108 per ton, and iron and steel are firm, and under the circumstances several of the largest makers appear determined that rather than sell at prices less than those now quoted they will close their works. The most important event of the week ending the 22nd inst. has been the resumption of work at the Landore Siemens Steel Works, and a prolonged strike averted. The imports for the latter part of the month are much less than the average.

An entirely new type of warship, which will be named the *Sharpshooter*, is to be commenced at Devonport Dockyard, on the slip from which the *Sandfly* was recently launched. The displacement of the new boat is to be 700 tons, and machinery of 4,500 I.H.P. will be provided.

The engineer and superintendent of the Australian United S.N. Company have completed plans for four new steamers which the company proposes to have built for the intercolonial trade. The "Colonies and India" says the new steamers are to be capable of making 15 knots an hour, and will each provide accommodation for 100 saloon and 80 second-class passengers.

A series of trials have lately been made at Havre of an electric launch, intended for use in the French navy. The propulsion is effected by one of M. Kreb's electromotors, which during the trial developed about 12 H.P., the current required being obtained from a set of accumulators 132 in number and weighing about two tons. The boat attained a speed of 6½ knots, which was maintained for about five hours.

The Eads Tehuantepec Ship Railway Company intends to take out a charter under the laws of the State of New York, and as soon as this shall have been accomplished, and the final arrangements made work, will be commenced. The plans and designs for the undertaking were finished before Captain Eads' death. The time required to complete the undertaking was estimated by Captain Eads at from three to four years.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

Since last report was made on the state of Clyde shipbuilding it is pleasing to state that nearly 30,000 tons of new shipping have been ordered from the various firms established on the river and firth, while a few orders have been booked by East-coast builders. Details of this needed augment to the existing work on hand will be given further on, but it may be stated that quite as large an amount as the tonnage already secured is likely to fall into the hands of Clydeside firms at no distant period. In Clyde shipbuilding circles much interest is being manifested in the decision regarding the tenders for the new additions to the Hamburg-American line of steamers between Hamburg and America. The steamers in question, of which there are to be two, if not three, are to be about 6,000 tons each, and are to have triple-expansion engines of great power. The steamers are to be ready for the summer of 1888, and although builders from all the centres of shipbuilding in Britain and the Continent are at present infesting Hamburg, it is probable that Clyde builders will succeed in obtaining the order.

The engineer and superintendent of the Australian United Steam Navigation Company have completed plans for four new steamers which the company propose to have built on the Clyde for the intercolonial trade. These steamers are to be capable of making 15 knots an hour, and will each provide accommodation for 100 saloon and 80 second-class passengers. Clyde engineers, in common with other engineering firms of repute throughout the country, have lately sent in offers to the British Admiralty for the construction of three sets of triple-expansion engines each of 1,200 H.P., for a similar number of composite gunboats being built for the Government, and two sets of oscillating engines, each of 450 H.P., for paddle steamers for surveying work.

The Troon Shipbuilding Company secured near the beginning of the month a contract for a steamer of over 2,000 tons for the British India Steam Navigation Company. Messrs. Barclay, Curle & Co., Whiteinch, have also booked contracts for a steamer of 3,000 tons for a Leith firm of shipowners, and one of 3,600 tons for the West India and Pacific Steam Navigation Company of Liverpool. The engines for the last-mentioned vessel, which are to be of the triple-expansion type, will be made by Mr. David Rowan, of Glasgow. The length of the steamer is to be 340 ft., breadth 41 ft., and depth 27 ft. This Company have not had for a long time vessels built on the Clyde, the latest additions to their fleet having come from a yard at Belfast.

Messrs. W. Denny & Brothers of the Leven Shipyard, Dumbarton, have contracted with the Belgian Government to build a large paddle-wheel steamship for the Ostend and Dover service, which will have a very high rate of speed, and be fitted up in a most luxurious manner. The speed, we understand, guaranteed is the abnormally high one of 21 knots. Messrs. A. McMillan and Son, of the same town, have secured a contract to build two composite vessels of moderate dimensions for foreign owners, and also two small iron tug steamers.

Messrs. Chas. Connell & Co., Scotstown, have booked a contract for a sailing ship of 1,600 tons. As Messrs. Connell launched the last vessel in their yard some time previous, the securing of this will enable them to retain a number of workmen in their employ.

The Abercorn Shipbuilding Company, of Paisley, received at the beginning of the month an order to construct, for South American owners, a screw steamer of the following dimensions:—Length, 100 ft.; beam, 19 ft. 6 in.; depth, 9 ft. 6 in.; The engines are to be supplied by Messrs. Hanna, Donald & Wilson, Paisley. The same company have recently received an order from the Indian Government to build and engine a torpedo boat to be used in the harbour defence of Calcutta. The vessel will be supplied with triple-expansion surface-condensing engines of 900 H.P. These engines are to drive the vessel at the rate of 23 knots per hour. In addition to these engines, there will also be engines for working torpedo-gearing, electric-lighting, forced-combustion, air-compressing, air-accumulators, and for freshwater-condensing. All the engines are to be supplied by Messrs. Hanna, Donald & Wilson.

Messrs. D. & W. Henderson & Co., Partick, have secured an order for a sailing ship of about 2,000 tons. The booking of this contract was opportune, as they launched a week previous the last vessel on their stocks—an Allan Liner named the *Monte Videan*. In addition to the sailing ship, they have on their books an order for a steamer of 1,200 tons for Messrs. M. Langlands and Son, Glasgow.

Messrs. Alex. Stephen & Sons, of Linthouse, whose spell of briskness had about exhausted itself, booked about the 25th a contract for the building and engining of two steamers of fully 2,000 tons each. Messrs. A. & J. Inglis, Pointhouse, are moderately well employed still with their large 5,000-ton "spec" steamer, and the 2,000 steamer for a Tasmanian company.

Renfrew continues to produce its staple type of marine craft—dredgers and hopper barges—in considerable numbers. Messrs. Lobnitz & Co., during the past six years, have built for the Suez, Panama, and other companies' works, more than 26,000 tons of dredgers, floating cranes, hopper barges and tugs, with over 20,000 I.H.P. of machinery.

At Greenock, matters have not been so bad as they are at present for the past 20 years or more. Messrs. Russell & Co. seem to be the only firm having more than the proverbial "bare poles" to show in their establishment. They have four vessels in their Greenock yard, three being steamers and one a sailing vessel. Two of the steamers are *unique* in the shipbuilding annals of the Clyde, intended as they are for the petroleum bulk carrying trade.

The *Britannia*, built by Messrs. Caird & Co., has now been handed over to her owners, the Peninsular and Oriental S. N. Company, after a very satisfactory trial of her speed. Her sister ship, the *Victoria*, also built by Messrs. Caird & Co., has been distinguishing herself in the matter of a swift passage to the East, and it is anticipated the *Britannia* will not be behind in this respect. With the completion of the *Britannia* Messrs. Caird and Co. completely exhausted their work, and consequently discharged all their workmen, with few exceptions, on the 15th ult., including both shipbuilding yard and engine works hands. With a view to affording some little employment to their more trusted work-people, and in order to improve their premises, Messrs. Caird began some weeks ago to effect alterations in their yard. This work is being done under the supervision of the foremen, with a few men and apprentices, the working time being only five days a week, and five hours per day.

Messrs. Rankin & Blackmore, of Eagle Foundry, also paid off a goodly number of hands about the middle of the month, owing to the approaching completion of the work on hand; and Messrs. Scott & Co., shipbuilders, about the same time had to suspend a number of their workmen, the vessels on hand not being sufficiently advanced to give employment to the number of hands then in the yard. It was intimated that over 300 men discharged at Greenock found employment in Belfast.

The past month has seen the completion on the Clyde of two notable war vessels. These are the *Galatea*, by Messrs. R. Napier and Sons, for our own Government, and the *Reina Regente* for the Spanish Government, built by Messrs. J. & G. Thomson, of Clyde Bank. The former vessel is a sister ship to the belted cruiser *Australia*, whose trials with armament complete has lately given much satisfaction. The *Galatea* steamed down the river on the 18th ult., and attracted considerable attention. After a trial of her engines she steamed round to Portsmouth, there to be supplied with armament, her escort being H.M.S. *Valorous*. The *Reina Regente* went on her official cruise on the Clyde on the 10th ult., and proved herself the fastest cruiser afloat. During a continuous four hours' trial run she maintained a speed of 20·73 knots per hour, the maximum being a little over 21 knots. The engines indicated nearly 12,000 H.P., and made 106 revolutions per minute, the boilers working at a pressure of 140 lbs. The nearest approach to the *Reina Regente* in speed is the *Dongola*, an Italian vessel, which steams 19¾ knots. The British Government cruisers of the *Archer* class make 19 knots.

Those engineering firms on the Clyde who do work for shipbuilders who are not themselves engineers, are fairly well employed either with new work or with conversion work from double to triple compound. Messrs. Dunsmuir & Jackson, of Govan Engine Works, have several sets of triple-expansion engines on hand, one set being for a steamer building at Whitehaven, and another and larger set for a 3,000 ton steamer building by Messrs. Russell at Greenock. Messrs. Dunsmuir & Jackson are adding to their plant, and are about to erect a splendid new fitting and erecting shop. Messrs. James Howden & Co., of Scotland Street Engine Works, are also fairly well off, one of their contracts being a set of triple-expansion engines for a 2,500 ton vessel, also building by Messrs. Russell & Co.

Messrs. David Rowan & Co. have also several medium-sized contracts on hand. The firms doing smaller work, such as winches, windlasses, and deck machinery generally are not so busy as the extent of the work on hand in Clyde yards should warrant. They are being handicapped heavily by English firms.

It is stated that the starting of a new shipbuilding yard on the Carron is at present in contemplation by gentlemen presently connected with shipbuilding in the district. The plant to be laid down will include a patent slipway, capable of hauling up the largest vessels entering the harbour. This will greatly improve the ship-repairing facilities of the port, and, it is expected, give employment to a large number of hands.

Leith, like other ports, is at present suffering from depression in the shipbuilding trade. The output during the present year has been comparatively small, and during the last few years it has been gradually on the decline. In 1885 the aggregate tonnage of the vessels launched in that port was 7,759 tons, in 1886 it amounted to 5,340 tons, and this year it will not exceed 4,000 tons. In Messrs. Ramage & Fergusson's yard the only vessels constructed were a large twin screw steamer, of 2,260 tons, named the *Fatchan*, for river service in China, and three steam yachts of 620 tons, 320 tons, and 215 tons, respectively, in addition to a steel yawl and a small steam launch, in all about 3,400 tons, or about 2,000 tons less than that launched from this yard last year. Messrs. S. & H. Morton & Co.'s yard is at present practically empty. Since the pleasure steamer, *Tantallion Castle*, was launched in the spring, the firm have only built a small steam tender for service at the Cape. There are only two vessels in course of construction in Messrs. Ramage & Fergusson's yard, and there is little prospect of this number being augmented, at least for a considerable time.

Messrs. John Scott & Co., shipbuilders, Kircaldy, have been commissioned by the directors of the London, Woolwich, and Clacton-on-Sea Steamboat Company to build a steamer of considerable size and great speed for the summer traffic between Clacton and London.

At Aberdeen, during the past month, the workmen in Messrs. Hall, Russell & Co.'s yard having struck work for an advance in the rate of remuneration for certain kinds of work, were refused their demand, and they subsequently resumed work under the old conditions from 2d. to 6d. extra per day in place of a uniform rate of 1s. per day extra, as they had demanded.

The Clyde Trustees have under consideration the proposed widening of the river above Bowling. A plan by the engineer showing the proposed widenings on the south side of the river opposite Bowling, and on the north side from Douglas Castle to a point below the mouth of the Leven, the dredging involved amounting to 3,800,000 cubic yards, has been remitted to the general manager, and the Committee on New Works, has also agreed to visit the locality.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—An improving tendency continues to be manifested in the shipbuilding trade, and inquiries are more frequently leading to the transaction of business than was the case a few weeks ago. The firmness which has recently been shown in the freight market is beginning to stimulate, though in a slight degree, the demand for tonnage, and owing to this favourable change in the situation, winter prospects for both operatives and employers have brightened considerably. Among the most recent additions to the prospective work in the district is a vessel nearly 400 ft. long, which is to be laid down by Messrs. Stephenson and Co., Hebburn. This will be the second vessel undertaken by the firm, the first not being yet off the stocks. It is, however, well advanced in plating, and will soon be put into the water. Messrs. Hawthorn & Leslie have six vessels in progress, and orders for as many more are understood to have been received by the firm. Messrs. Palmer have five exceptionally large steamers in different stages of construction, and the yard is pretty brisk. This firm are now manufacturing and using ship plates that are 28 ft. long (covering 14 frames) and from 4 to 5 ft. in width. A few years ago the length of skin plates seldom exceeded 10 ft., but that was when they were manufactured of iron. The saving of labour and material effected by the introduction of these longer plates is of course very considerable, and such firms as can, like Messrs. Palmer, use the extreme lengths indicated, are obviously placed in a position of great advantage over competitors who, in the matter of plant, are not so well provided. Messrs. Swan and Hunter have still practically an empty yard, but the remarkable energy displayed in the management of this establishment for years past is likely soon to bring about a restoration of the old order of things, when all the berths were occupied. The fitting out of vessels still engages the services of a good many operatives,

and it is believed that before these are quite out of hand the initiatory stages of others will have been entered upon. Messrs. Schlesinger & Davis have been commissioned to build a large steamer for the Tyne Steam Shipping Company, and this contract, independently of any others which may be obtained, will keep the machinery going over the winter months. Messrs. Armstrong and Mitchell's Low Walker yard has slackened greatly during the past few weeks, but the construction of a large oil-carrying steamer is now being commenced, and it is said that the firm have two others of the same type to proceed with. The firm have lately disposed of two very large vessels, which came into their possession about a year ago, and have since been thoroughly overhauled and re-engined. They have been named the *Atlantica* and *Pacifica*, and are, it is understood, intended for the Australian passenger trade. Messrs. W. Dobson and Co. have commenced the construction of two large hopper barges, and have launched one of the Russian steamers referred to in last month's notes. The second of these vessels is nearly ready for putting off the stocks. Messrs. W. Richardson and Co. have disposed of a vessel that has lain for some time completed on their stocks, and the launching arrangements are now in progress. There is still another unsold steamer of large size in the yard. The firm have launched a small vessel during the month, and have secured an order for one of more than average dimensions. Messrs. Edwards have put down a second keel this month, and other berths will be shortly occupied. Messrs. Readhead have the whole of their five building berths engaged, all the vessels being of large size, and all but one in comparatively early stages. The establishment is just now among the busiest on the river, and this enviable position is pretty certain to be maintained well into next year. Messrs. T. & W. Smith, North Shields, are building a small steamer, and they continue to secure a good proportion of repair work. The other repairing establishments at Shields have not been particularly busy lately. The St. Peter's Engine Works were perhaps never so busy as at this moment. A full staff of patternmakers is kept on, and in this department overtime is being worked nightly. Among the contracts in progress, the powerful engines of the Italian ironclad *Sardegna* form a conspicuous item, but there are some other very heavy engines in hand, besides a considerable number of lighter ones. The marine engine works at other centres on the river are all busy, and some of them particularly so. The improvement in the engineering trade has effected a corresponding improvement in forges and foundries. In locomotive work there is but a limited amount of business doing, and at the Elswick Ordnance Works signs of lessening activity are apparent. Messrs. Black & Hawthorn, Gateshead, are kept very busy with the manufacture of stationery steam engines, gas engines, and other specialties; and at Messrs. Abbot's factory a colonial order for hydraulic machinery is causing some stir in the fitting shops. The bridge department at Messrs. Hawkes, Crawshay & Son's works keeps busy, but in other departments there is very little animation to be noticed. Mr. Wasteneys Smith, of Newcastle-on-Tyne, has just been entrusted with several important orders for outfits of his patent stockless anchors from Clyde shipbuilders, and has also been successful in securing the anchor outfits for a number of the new vessels lately placed with Tyne and Wear builders. The system of stowing these anchors up the vessel's ordinary sized hawse pipes is rapidly coming into general use, upwards of 50 large new steamers having already been fitted this way, and some good orders to hand from abroad plainly indicate that this method is also commending itself to foreign shipowners and builders.

The Wear.—Since last month a more sanguine feeling than was before noticeable has arisen among commercial circles on the Wear, and it is a pleasing duty to have to state that there are substantial reasons for the change. Several important orders have been booked by the leading shipbuilding firms, and some of the principal engineering establishments have also received a large accession of work. Messrs. J. L. Thompson & Sons have probably secured the largest number of recent orders, and though there is at the time of writing but one vessel on the stocks, berths are being got ready for the laying down of two others, and frame turning, which has been suspended for some time, will be re-commenced immediately. The firm launched on the 19th inst. a steel steamer built to the order of a local firm, and they have had two or three important repair contracts in hand during the month. Messrs. Short Brothers also launched on the 19th a vessel which was built for local owners, and is of exceptionally large tonnage. This firm are now laying the keel for a much larger vessel, and they have several other orders to proceed with, besides three good-sized boats that are in early stages of construction on the stocks. Owing to the fact that vessels of large dimensions are being more frequently inquired for than hitherto, this firm are re-arranging their building berths, with the view of giving them greater length and width. Last month Mr. James Laing had no new work whatever, and to keep his establishment in even partial operation, was under the necessity of putting down a vessel on the speculative principle. Since then this well-known builder has booked four or five orders, among them being one for a large cargo boat, from a Shields shipowning firm. Messrs. Doxford launched a vessel early in the month, and have also commenced frame-turning for one. This firm have been among the recipients of orders lately, and a fairly busy winter in their yard is anticipated. The firm are about to supply with new engines and boilers a large Spanish passenger steamer named the *Cristobal*, of Barcelona, which has arrived in the port. Messrs Bartram & Haswell have an empty yard at present, but the material for a large vessel has been received, and operations will shortly be re-commenced. Messrs. R. Thompson & Sons have been fairly well off for work in the repair line, but the only occupant of the stocks at their Southwick yard is a large nearly completed steamer, which was built as a speculation and is still unsold. Within the past week or two orders have rapidly accumulated at the Palmer's Hill Engineering Works, and a busy time is now assured till a late period of next year. The firm are at present engining two locally owned vessels, and have orders for crank shafts (Dickinson's patent) for steamers belonging to other ports. Messrs. G. Clark and Co., of the Southwick Engine Works, are understood to have secured half-a-dozen orders this month, and their establishment is daily becoming busier. At the North-Eastern Engine Works, South Dock, business is moderately good, and an improvement is expected. The Pier Engine Works are kept steadily employed with the manufacture of Smith & Stephen's interchangeable chain wheel, and several orders for "governors" have lately been received. Mr. A. A. Rickaby, of the Bloomfield Engine Works, Monkwearmouth, has several orders for his "patent metallic packing," and "patent self-adjusting metallic outer rings." In respect of these specialities, it is claimed that they are superior, in their respective uses, to any other appliances of the same description now in use. A very good indication of improved business in the district is to be found in the fact that two forges which had been idle for some time have resumed operations, and at one of them there are no less than six large stern frames to be made for vessels to be built on the Wear. The foundries also show a marked increase of work, and the largest one in the district, which has been very slack during the earlier months of the year, is just now working to its full capacity.

The Tees.—The construction of two large vessels has been commenced at Messrs. Raylton, Dixon & Co.'s yard, Middlesboro, and an important repair contract is also being proceeded with. None of the yards at Stockton are very busy, but in each case there is sufficient work in progress to keep a limited number of hands employed. Engineering works and boiler works keep busy, but in bridge building establishments, no special activity is to be noticed. Steel works are fully employed, and another large ironworks in the Cleveland district is being altered with a view to being utilized for steel production.

The Hartlepools.—Messrs. W. Gray & Co.'s yard, West Hartlepool, may now be described as one of the very busiest establishments on the north-east coast. Frame turning is being carried on night and day, and besides five large vessels, which are in various stages of progress on the stocks, keels for four or five others are in the yard. Messrs. Withey are also well provided with orders, and a busy winter is looked forward to by those interested in the prosperity of the establishment. This firm are usually among the first to adopt improved methods of working, and as an illustration of this it may be stated that they are now, by the use of specially constructed hydraulic machinery, bending steel keel or garboard plates cold. Both the marine engineering establishments at this centre remain busy. It is stated that the West Hartlepool Ironworks will very shortly be devoted to steel production.

Two steamers, the *International* and *Kangaroo*, have been chartered by the Italian Government to proceed to Massowah, for the purpose of distilling water for the use of the troops there. The distilling plant on both vessels has been furnished by Messrs. John Kirkaldy & Co., who supplied similar apparatus to the English Government in the Egyptian and Soudan expeditions.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Perseverance.—On October 1st Messrs. Laird Brothers launched from their works at Birkenhead the twin screw steamer *Perseverance*, the second of two which they have constructed to the order of the Amazon Steam Navigation Company (Limited), and which are to be employed on the River Amazon in connection with an extended service which the company has undertaken. The ceremony of christening was performed by Miss Hudson, daughter of Captain Hudson, the marine superintendent. The *Perseverance* is built of steel to Lloyd's highest grade of classification for river service, and divided by longitudinal and athwartship bulkheads into 11 watertight compartments, by which security against accident is ensured. There is an awning deck, supported on stanchions and open at sides, above mainrail, and a feature in the construction of the vessel is that the area of main and awning decks is much increased by sponsoning out beyond the sides, the sponsons being specially protected against snags by permanent iron guards attached to the supporting stays. Her dimensions are:—Length, 181 ft.; beam, 28 ft.; over sponsons, 36 ft.; depth in hold, 9 ft. 6 in.; tonnage, O.M., 680 tons. She is intended to carry about 200 tons deadweight on 6 ft. 6 in. draught of water, and to have a speed of 12 knots. The machinery consists of two sets of compound triple-expansion engines, with cylinders 13, 19½, and 33 in. diameter and 2 ft. stroke, each set with its furnace condenser, air and circulating pump, and capable of exerting about 750 I.H.P. collectively, steam at 150 lbs. pressure being supplied by a cylindrical steel boiler with four corrugated furnaces, the machinery combining all the latest improvements with a view to economy in fuel and stores. The *Perseverance* has accommodation for 60 first-class passengers in state-rooms on the forward part of awning deck, while at the after-end the dining table and seats are arranged under a permanent wooden awning, and protected at the side by canvas curtains. The cabins will be most completely furnished with every appliance necessary for the comfort of passengers and with due regard to the climate, the important matter of ventilation having been specially attended to. The officers' quarters are on the main deck aft, and the crew are berthed in a topgallant forecastle. Provision is also made on the main deck for carrying a number of cattle. The cargo will be worked through four side hatches by powerful steam winches, and the general outfit of the steamer will be very complete, including direct-steam windlass, Emerson & Walker's patent, steel boats, &c. The *Perseverance* is the sixteenth steamer built for the Amazon Steam Navigation Company by Messrs. Laird.

Peter.—On October 1st Messrs. William Dobson and Co. launched from their shipbuilding yard at Newcastle, a steel screw steamer which they have constructed to the order of the Russian Company for Sea, River, and Land Insurance and Conveyance of Goods. The vessel is 220 ft. long, 30 ft. beam, and 21·7 depth moulded, and will be fitted with triple-expansion engines of 650 H.P., which are being supplied by the North-Eastern Marine Engineering Company of Wallsend. The vessel has been constructed under the supervision of Captain Safanoff, and the machinery under the superintendence of Mr. Lapoonoff, the engineer for the company. On leaving the ways she was named the *Peter* by Mrs. Safanoff. This is the first of four vessels which are being built for the company for their service on the Black Sea.

Scorpio.—On October 1st Messrs. Earle's Shipbuilding and Engineering Company, Limited, launched from their yard at Hull an iron steam trawler named the *Scorpio*, a sister ship to the *Sagittarius*, which they have built for the Grimsby and North Sea Steam Trawling Company, Limited, and which will be launched from the same yard shortly. These boats are 107 ft. 3 in. long by 20 ft. beam by 10 ft. 9 in. depth of hold, and are of somewhat similar design and arrangement to the *Zodiac*, the plans of which took prizes at the Shipwrights' Exhibition in London in 1882, and at the International Fisheries Exhibition, 1883, but in many respects they are a decided improvement on that ship, as well as on the *Virgo* and *Libra*, recently constructed by Earle's Company for the same owners. The new vessels will be provided with all the modern requirements for trawl fishing, such as Earle's special steam trawling winch, patent capstan windlass of the horizontal type, by Emerson, Walker & Co., &c. They will also be fitted by the builders with their triple-compound three crank engines, capable of indicating 200 H.P., and having cylinders 17½ in., 17 in., and 30 in. diameter by 18 in. stroke, which will be supplied with steam from a steel boiler made in accordance with Lloyd's rules for a working pressure of 140 lb. per square inch.

Flambro.—On October 4th Messrs. W. Gray & Co. launched from their yard a steel screw steamer of the following dimensions:—294 ft. by 37 ft. by 22 ft. 2 in., moulded, of large deadweight capacity, built to the order of C. M. Webster, Esq., Pallion Hall, Sunderland, and classed 100 A1 at Lloyd's. This is the eighth vessel the builders have launched for the same owner. She is of the improved well-decked type, having the bridge extended forward to the fore hatch. The poop aft contains handsome accommodation for officers and a few passengers. Comfortable quarters are provided for the crew in the fore-part of the bridge. Emerson, Walker & Co.'s windlass is fitted on the forecastle to work Parke's patent anchors, stowing into the hawse pipes without the use of the usual crane and cat and fish tackling. The hull is built with web frames, giving strong sides, and dispensing with hold beams, thus avoiding any obstruction in the working of cargo. A cellular double bottom is fitted throughout for water ballast. Five hatches, two donkey boilers, four steam winches, and steam-steering gear are fitted, and the ship is thoroughly equipped as a general trader. Triple-expansion engines of the most approved design and construction are being supplied by the Central Marine Engineering Company, West Hartlepool, with cylinders 22 in., 35 in., and 59 in. diameter, with 39 in. piston stroke. Two large boilers made of steel, for a working pressure of 162 lb. per square inch, will give an ample supply of steam for working the engines at 1,000 I.H.P. During construction the vessel has been superintended by Captain G. Wright. The christening ceremony was gracefully performed by Miss Amy Barraclough, daughter of Thomas Barraclough, Esq., manager of the West Hartlepool Steam Navigation Company, and the vessel named *Flambro*.

George Heneage.—On October 4th a smack, built by the owner, Mr. Thomas Campbell, was successfully launched from that gentleman's yard, at Hull. The vessel as it left the ways was christened *George Heneage*, the ceremony being performed by Miss Heneage, daughter of the Right Hon. Edward Heneage, M.P.

Kate B. Jones.—On October 15th Messrs. Schlesinger, Davis and Co. launched from their shipbuilding yard at Wallsend a large steel screw steamer named the *Kate B. Jones*, which is of the following dimensions:—Length between perpendiculars, 270 ft.; breadth, moulded, 37 ft.; and depth, moulded, 21 ft. 8 in. The vessel is built on the cellular bottom principle for water ballast in holds, has a long raised quarter-deck with long bridge and topgallant forecastle, with full poop above the quarter-deck aft. Shifting boards will be fitted in each hold for the carrying of grain cargoes. She will be rigged as a topsail schooner with two masts, and will also be supplied with one of Alley & McLellan's patent combined steam and hand steering gears fitted in the wheel-house on bridge amidships. Hastie's patent screw steering gear will be placed on the poop aft. The vessel will also have one of Emerson, Walker & Thompson Bros'. patent capstan windlasses fitted on the forecastle. Four powerful steam winches will be supplied for the rapid loading and discharging of cargo. The *Kate B. Jones* classes 100 A1 in steel at Lloyd's and has been built under special surveys. Captain Thomas, who has superintended the construction of the vessel, will take command of her. The engines are of 180 N.H.P., having cylinders 21 in., 35 in. and 58 in. diameter, and 39 in. length of stroke of the triple-expansion description, and will be immediately put on board by the North Eastern Marine Engineering Co., at their works, Wallsend. This is the second vessel built by Messrs. Schlesinger, Davis & Co. for the same owners, Messrs. Jones & Thomas, of Cardiff. As the vessel left the ways she was gracefully christened by Mrs. William Jones, wife of one of the owners.

Sagittarius.—On October 15th Messrs. Earle's Shipbuilding and Engineering Company (Limited), launched from their yard at Hull an iron steam trawler, named the *Sagittarius*, which they have built for the Grimsby and North Sea Steam Trawling Company (Limited). This boat, like the sister ship *Scorpio*, recently launched, is 107 ft. 3 in. long, by 20 ft. beam, and 10 ft. 9 in. depth of hold, and is of somewhat similar design and arrangement to the *Zodiac*, the plans of which took prizes at the Shipwrights' Exhibition in London in 1882, and at the International Fisheries Exhibition, 1883, but in many respects these vessels are a decided improvement on the *Zodiac*, as well as on the *Virgo* and *Libra*, recently constructed by Earle's Company for the same owners. The new vessels will be provided with all the modern requirements for trawl fishing, such as Earle's special steam trawling winch,

windlass, &c. They will also be fitted by the builders with their triple compound three-crank engines, capable of indicating 200 H.P., and having cylinders 11½ in. and 17 in. diameter, by 18 in. stroke, which will be supplied with steam from a steel boiler, made in accordance with Lloyd's rules for a working pressure of 140 lbs. per square inch.

Viceroy.—On October 15th this vessel was successfully launched from the yard of Messrs. William Doxford & Sons, at Pallion. She has been built to the order of William Kish, Esq., of Sunderland, for the general trades, and is entirely built of steel, to Lloyd's 100 A1 class. The principal dimensions are:—Length between perpendiculars, 275 ft.; breadth, 39 ft. 6 in.; depth moulded, 21 ft.; with cellular bottom fore and aft. The engines are triple-expansion, three cranks, with all Messrs. Doxford's latest improvements, the cylinders being 21 in., 35 in. and 57 in. diameter respectively, and 39 in. stroke, and they are supplied with steam from exceptionally large boilers. She is fitted with Lynn's patent steam steering gear and Hasting's screw gear aft, and four winches by Messrs. Welfords, of Pallion, multitubular donkey boiler, patent steam windlass, Emerson, Walker & Co.'s patent, and with all the most recent improvements for cargo purposes. The cabins are most tastefully constructed in hardwood and Lincrusta Wallor in the poop and aft, and give most comfortable quarters for captain and officers. The crew and firemen have exceptionally large and comfortable quarters at fore end of bridge. Poop deck is done with Tagg's patent caulking. The christening ceremony was most gracefully performed by Mrs. William Kish. We understand the vessel is already chartered to load 2,000 tons of coke for Bilbao early in November, which will be within four and a-half months from the date of order, and considerably within the contract time for delivery. The vessel has been surveyed during construction by Captain Herne, on behalf of the owner, and will sail under his command.

Eugalia.—On October 17th there was launched from the yard of her builders, Messrs. Raylton, Dixon & Co., a steamer built for foreign owners, which was named the *Eugalia*. The vessel, which is built of steel, is of the following dimensions: Length over all, 183 ft.; breadth, 26 ft. 6 in.; depth, moulded, 15 ft. 1 in.; and she will have a deadweight capacity of 750 tons. She has water ballast throughout on MacIntyre's system, and accommodation for captain and officers at after end. She will be fitted with triple-expansion engines of 80 H.P. by Messrs. Blair & Co., Limited, of Stockton, and one of Emerson, Walker & Co.'s patent windlasses.

Exeter City.—On October 18th the Blyth Shipbuilding Company (Limited), launched from their building yard at Blyth a steel screw steamer, 285 ft. long, 38 ft. beam, and 24 ft. depth of hold. The vessel has been constructed to the order of Messrs. Charles Hill & Sons, of Bristol, and was named the *Exeter City*. She has been built to the three deck rule and considerably above the requirements for Lloyd's highest class. Has poop, bridge, and topgallant forecastle, six bulkheads extending to the upper deck with a divisional longitudinal bulkhead in the 'tween decks to prevent shifting of cargo, water ballast in after hold under boilers and in deep hold tank forward of boilers. There are four hatches with five of Clarke, Chapman, Parsons & Co.'s powerful steam winches, these winches also being arranged to work the bilge pumps. A patent windlass and steam steering gear by same makers, and Crawford's screw steering gear are fitted aft. The deck machinery is supplied with steam from two large donkey boilers fitted in the stokehold. She is schooner-rigged, with two iron polemasts, and has a very large spread of canvas. The accommodation for captain, officers, and spare state-rooms for passengers are to be in the poop. The engineers and petty officers' cabins are placed at the fore end of the bridge. Store and ice-rooms are also under the bridge. The crew are berthed in the forecastle. The vessel is intended to run between Bristol and New York, and will be supplied with all the latest improvements to facilitate the loading and despatch of cargo. The engines are of the triple-expansion type, and will be fitted by Messrs. Blair and Co., of Stockton-on-Tees. The vessel has been built under the supervision of Mr. Bailey, the owners' surveyor, and her fitting out will be under the inspection of Captain Weiss, who will command the vessel on her completion. The christening ceremony was performed by Mrs. Hargreaves, of Newburn.

Port Fairy.—On October 18th Messrs. Wigham Richardson and Co. launched a steel steamer, named the *Port Fairy*, for William Milburn & Co.'s Australian service. Her dimensions are 337 ft. by 38 ft. by 27 ft. 6 in., the lines being unusually fine. The vessel is to be rigged as a three-masted schooner, and has a clipper prow. The saloon has accommodation for 25 persons. In the 'tween decks accommodation is provided for 350 to 460 first-class passengers, and in case of need a limited number of second-class passengers can be carried. The engines are capable of indicating 2,100 H.P., and it is expected that the vessel will steam 12 knots average in her laden trim, or 13½ knots in light trim. The christening ceremony was performed by Miss Hodgkin.

Cragside.—On October 19th Messrs. Joseph L. Thompson and Sons launched from their shipbuilding yard at the North Sands, Sunderland, a steel screw steamer, built to the order of Mr. Wm. Kish, of Sunderland. The vessel is of the following dimensions, viz.:—Length, 284 ft.; breadth, 38 ft.; depth of hold, 18 ft. 3 in.; of about 3,100 tons deadweight capacity, and is to class 100 A1 at Lloyd's. The vessel is constructed on the improved cellular bottom and web frame system, having also longitudinal intercostal stringers, dispensing with the ordinary 'tween deck and orlop beams, these fore-and-aft stringers being efficiently bracketed and connected with each watertight bulkhead. Each hold is divided with a steel bulkhead, and the water ballast is sub-divided with separate compartments, having independent filling and discharging suctions. This vessel is built of Siemens-Martin steel, made by the Consett Steel Company, Blackhill. The engines are being built by Mr. John Dickinson, of Palmer's-hill Engine Works, and are of the triple-expansion type, having improved valve gear and patent crank shaft specially designed by the builders for this type of engine. The cylinders are of 21½ in., 35 in., and 58 in. diameter respectively, with a stroke of 39 in., supplied with high pressure steam from boilers of 160 lbs. pressure to the square inch. The naming of the vessel *Cragside* was performed by Miss Laws, of the Grange, Ryhope. The *Cragside* is being fitted with patent screw steering gear aft and steam midship gear; four large horizontal steam winches by Lynn, of Sunderland; and patent windlass and stockless anchors. She will be rigged as a two-masted schooner, having all the improved additions of the modern cargo vessel.

Apollo.—On October 22nd there was launched from the yard of Messrs. Earles Shipbuilding and Engineering Company, Limited, the *Apollo*, a screw steamer, built to the order of Messrs. Thomas Wilson, Sons & Co., for their Bombay trade. The dimensions are 330 ft. by 41 ft. by 29 ft., and the ship is constructed to Lloyd's highest class of steel. She has two complete steel decks, and bridge deck extending over engine and boiler space, a turtle back forward, and house aft, with hood enclosing the stern. Accommodation is provided under the bridge for captain and 12 passengers, with comfortable dining saloon, state rooms, and every necessary convenience, all fitted up in a very substantial manner. The officers and engineers are berthed in the house aft, and the seamen and firemen forward under the upper deck. The holds and 'tween decks are thus entirely available for cargo. Water ballast is provided for in two large hold tanks, suitable for cargo; the pumping arrangements for these and the rest of the ship being very complete and efficient, as there are large deck pumps worked from the winches, as well as the engine room pumps. The ship is rigged as a schooner, with two pole masts, and very complete and ample arrangements of derricks and booms are carried out for the quick working of cargo. The provision for steering is of extra strength, and consists of a steam steering gear made by Messrs. Amos & Smith, and a powerful Hastie's hand screw gear. The rudder and portion of the stern frame are made of cast steel, manufactured by Messrs. W. Jessop & Sons, Limited, of Sheffield. Her machinery, which has also been made by the builders, consists of a set of triple-compound 3-crank inverted engines, has cylinders 25 in., 40 in., and 60 in. diameter, and 48 in. stroke, and two double end boilers of ample size, made in accordance with Lloyd's and Board of Trade requirements for a working pressure of 160 lbs. per square inch.

Olinda.—Messrs. J. F. Waddington & Co., Seacombe, have just launched a handsomely modelled steam launch built of galvanized steel to the order of Messrs. H. Savill & Co., of London, for the Brazilian Government, to the design of the builders under the direction of Mr. W. Tijou, M.I.M.E., London. The craft is 45 ft. 6 in. by 8 ft. 6 in. moulded, by 4 ft. 6 in. moulded, with bulwarks at ends and rails amidships. She is fitted with a neat cabin forward with large teakwood skylight to give ample ventilation in the tropics, also awning fore and aft. The engines (also built by Messrs. Waddington) are of C.S.C. type, having cylinders 6 in. and 12 in. diameter by 9 in. stroke, with their type of marine horizontal return tube boiler. On the preliminary trial of the engines they were found to work very

smoothly, running at a speed of 240 revolutions without the slightest hitch. The launch attained a speed of 10 miles per hour. She will be shipped in a few days to the Brazils.

LAUNCHES.—Scotch.

Vascougada.—On September 29th Messrs. Alexander Stephen and Sons launched from their shipbuilding and engineering works at Linthouse, a finely modelled steel screw steamer, 250 ft. by 35 ft. by 18 ft. 3 in., and about 1,500 tons gross, built to the order of Messrs. Ferguson & Reid, Glasgow, and intended for the Bilbao and general carrying trades. The vessel has been constructed under special survey of Lloyd's, with scantlings in excess of their requirements for the 100 A1 class. She has long raised quarter deck, bridge house amidships, under which is fitted saloon, captain's room, spare state rooms, officers and engineers' cabins, all neatly and comfortably furnished, while the crew are located in the usual top-gallant forecastle, which in this vessel has been carried much further aft than usual in order to prevent seas breaking on deck, the bridge and forecastle being joined by a gangway so that communication can be had fore and aft in heaviest weather without going down on to the deck. The vessel has double bottom on cellular principle for water ballast, and is fitted with all the most recent and approved appliances for the rapid and effective handling of ship and cargo. The engines, which were fitted on board before launching, are of the most improved triple expansion type, having cylinders 18 in., 29 in. and 46 in. diameter by 39 in. stroke, with a working pressure of 160 lbs. As the vessel left the ways she was named the *Vascougada*, by Mrs. Reid. The construction of the hull was superintended by Captain Ewer, and that of the engines by Mr. Peter Jackson.

Drysdale.—On October 4th the Abercorn Shipbuilding Company, Paisley, launched a powerful screw tug steamer, named the *Drysdale*, a vessel of about 80 tons burden, and measuring 80 ft. by 17 ft. by 9 ft. 6 in. She is being fitted at Paisley with a pair of surface-condensing engines of 45 H.P.N. by Messrs. Hanna, Donald & Wilson. Intended for the River Plate, she will be employed in carrying mails and passengers to and from the mail steamers, and she will also be available for towing purposes when required.

Kapwithala.—On October 4th Messrs. William Denny and Brothers launched from their shipbuilding yard at Dumbarton a steel screw steamship of 1,150 tons gross register for the British India Steam Navigation Company (Limited). She will be fitted by Messrs. Denny & Co., with triple-expansion direct-acting engines. The ceremony of naming the vessel the *Kapwithala* was performed by Miss M'Eachran, daughter of N. M'Eachran, Esq., Gleneden, Bothwell.

Dérocheuse.—On October 5th there was launched from the yard of Messrs. Lobnitz & Co., at Renfrew, a large marine dredger, named the *Dérocheuse*, which is intended to inaugurate a new and simple method of excavating subaqueous rocks. She is very powerful and strongly built, and embodies a novel principle in rock-breaking which was invented and patented last year by Mr. H. C. Lobnitz as a solution of the difficulty of widening and deepening the Suez Canal at the Suez end, where about three millions of tons of very hard rock will have to be removed. Instead of using the ordinary system of boring holes in the rock under water, and breaking up the rock by means of explosives, the work is done by means of heavy blows with long chisel-shaped cutters. These cutters weigh each about 4 tons, and when dropped a distance of, say, 20 ft., they break up and dislodge the rock in a most thorough fashion, ready for removal by dredging. This has been demonstrated by various dry land trials with these cutters on some of the hardest rock to be met with in Scotland. The cost of excavating and removing rock by the blasting system when working at, say, 30 ft. under water, may be 20s. per cubic yard. With the new system, of which the *Dérocheuse* is the pioneer representative, 4s. per cubic yard will easily cover the cost of breaking the rock and raising and carrying away the *débris*. Various trials, which were carried out from March to June of this year at Craigmillar Quarry, Edinburgh, under the personal supervision of engineers from the Suez and Panama Canal Companies, and Scotch and French engineers, have given most satisfactory results. At the last of these experimental trials, which took place on Tuesday, 6th September, there were present, among other gentlemen interested in the subject, the following engineers:—Messrs. John Strain, C.E., Glasgow; D. Westland, C.E., Edinburgh; A. Brebner, of Messrs. T. & D. Stevenson, Northern Lighthouse Board; W. Young, of Messrs. Hawthorns & Co.; L. David and H. Lapointe, of the Suez and Panama Canals; Waddell and Deas, jun., of the Clyde Navigation; also Mr. George Lawson, contractor for the Ardrossan harbour works; and others. The result of the trial showed an average of over 6 cubic ft. of rock dislodged for each blow of the cutter. This was more than was expected by the patentee, and caused considerable surprise to those present. Similar results were attained at the other trials already referred to. The lowest average result was about 4 cubic feet per blow of the light cutter used, and when the very hard nature of the rock at Craigmillar Quarry is considered, even this is a surprising result; but with the heavy cutters fitted for the present purpose, more than double that effect will be ensured. The dimensions of the *Dérocheuse* are:—Length 180 ft., breadth 40 ft., depth 12 ft., and she is divided into 18 water-tight compartments. She has machinery on board of a total indicated power of over 1,000 horses, including hydraulic engines and rams for working the ten rock-cutters, which are each 45 ft. in length. For these, ten 6-ton hydraulic hoists are provided, capable of lifting to a height of 60 ft., and working with a pressure of 1,000 lb. per square inch. By means of a set of levers one man can manœuvre the whole rock breaking apparatus without moving from his post, everything being self-acting and simple. The rock, when broken and dislodged, is immediately lifted by a powerful dredging apparatus, the buckets of which work between the rows of cutters. This dredging machine is fitted with Lobnitz's patent guide wheel and patent pitch wheel driving gear, and is specially designed for the present purpose. It is capable of dredging from a depth of 10 ft., down to a depth of 40 ft. below the surface of the water, and will dredge ordinary material with great ease and economy, and will also remove rocks of the most refractory nature. On deck the *Dérocheuse* is fitted with various powerful winches and cranes. There is special hydraulic gear on deck for manœuvring two steel pivots, which enable the vessel, when at work, to adopt a very neat system of covering the ground by a series of concentric curves. Thus the work never stops for the purpose of manœuvring, and every portion of the ground can be properly dealt with, leaving a level surface. In short, nothing that could tend to make the vessel efficient for her purpose has been omitted; and comfortable accommodation is provided in the vessel for the civil engineers, officers, and crew who will work her. Having twin screws, driven by two pairs of independent compound engines, solely used for propulsion, the *Dérocheuse* will steam out to her destination where she will be immediately set to work upon the rocky part of the bed of the Suez Canal. When on her station, the *Dérocheuse* will likely prove a great source of interest to many civil engineers and contractors who may require to carry out similar work. During the last six years, Messrs. Lobnitz & Co. have built for the Suez, Panama, and other companies' works more than 26,000 tons of dredgers, floating cranes, hopper barges and tugs, with over 20,000 I.H.P. of machinery.

Garceta Primero.—On October 6th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Monkland Canal, a steel screw passenger vessel; dimensions, 66 ft. by 12 ft. 3 in. by 6 ft. 9 in. This vessel is intended for carrying passengers and for towing purposes at Santander, Spain, and has two saloons fitted up for the accommodation of first and second class passengers, with ports through the sides of the vessel, and large companions and skylights on deck. An iron rail is fitted all round the deck, and sparred seats along the sides and at the middle of the vessel, and the vessel is further provided with an awning, covering the whole of the saloon deck. The engines, which are being fitted by Messrs. Ross & Duncan, Govan, to whose order the vessel has been built, consist of a pair of compound surface-condensing, having cylinders 7 in. and 13 in. diameter by 9 in. stroke, with steel return tube boiler 6 ft. diameter by 6 ft. long; and the vessel, which has been built with very fine lines, is expected to attain a high rate of speed.

Liddesdale.—On October 6th Messrs. Charles Connel & Co. launched from their works at Scotstoun a steel screw steamer, 300 ft. by 40 ft. by 24 ft. 6 in., built to the order of Messrs. Robert Mackill & Co., Glasgow, and intended for the Eastern carrying trade. The vessel has been constructed under special survey considerably in excess of Lloyd's requirements for their 100 A 1 class, and is fitted with water ballast right fore and aft on the cellular system. Accommodation is provided for a few passengers in the poop, and for the officers and engineers under the bridge amidships. The engines, supplied by Messrs. John and James Thomson, Finnieston Engine Works, are of the most improved triple-expansion type having cylinders 23, 37, and 59 by 42 in. stroke, with a working pressure of 160 lbs. As she

left the ways she was named *Liddesdale* by Miss Turner, Helensburgh. Mr. Wotherspoon, consulting engineer, has superintended the construction of the vessel, and she is to be commanded by Captain Houston, senior captain of the firm.

Monte Videan.—On October 20th Messrs. D. & W. Henderson and Co. launched from their yard at Meadowside, Partick, a steel screw steamer built by them for Messrs. James & Alexander Allan, owners of the Allan Line of steamers, which trade between this country and the Western Continent. The vessel, which is named *Monte Videan*, is a duplicate of the *Rosarian*, also built by the Messrs. Henderson, and launched about two months ago, and is intended, like her, for the River Plate trade. Both vessels have been built to the highest class at Lloyd's, and are constructed of Siemens-Martin steel, made by the Steel Company of Scotland. The dimension are :—Length, 330 ft.; breadth, 41 ft. 9 in.; depth, 28 ft. 3 in.; the gross register tonnage being about 3,000 tons, and the deadweight carrying capacity 4,300 tons. Engines of the triple-expansion type will be fitted or board, the I.H.P. of these being 1,400. The high-pressure cylinder is 22½ in. in diameter, the intermediate 36 in., and the low-pressure 61 in., the stroke being 48 in. While intended for cargo carrying, the vessel has been built so that, if required, accommodation can be provided for 600 third-class passengers 'tween decks, and 20 first-class passengers in the cabin in the after part of the ship. The *Rosarian* and *Monte Videan*, with the two Monarch liners recently purchased, make an addition of 15,000 tons to the Allan Line of steamers.

Victoria.—On October 20th Messrs. Alexander Stephen & Sons launched from their shipbuilding yard at Linthouse, Govan, a handsome steel screw steamer, having a deadweight carrying capacity of about 2,500 tons, classed 100 A1 at Lloyd's, under special survey, built to the order of Messrs. Maclay & McIntyre, Glasgow, and intended for general carrying purposes. She has a long raised quarter-deck bridge amidships, under which are saloon, spare state-rooms and accommodation for captain, officers and engineers, while the crew and firemen are located in a topgallant forecastle. She is fitted with steam windlass, steam steering gear, and all the most modern appliances for the effective and rapid working of ship and cargo. Her engines (also built by Messrs. Stephen) are of the triple-expansion type, with cylinders 18 in., 29 in., and 46 in., by 39 in. stroke, and having boiler of ample size, suitable for 160 lbs. pressure. On leaving the ways she was named *Victoria* by Miss McIntyre, Athole Gardens, Glasgow.

Volga.—On October 20th Messrs. Russell & Co. launched from their Kingston Yard, at Port Glasgow, an iron sailing ship, specially designed for the coolie trade, of the following dimensions: —Length, 257 ft.; breadth, 38 ft.; depth of hold, 23 ft.; and 1,615 tons net register. On the vessel leaving the ways she was named *Volga*, and is the duplicate of the *Elbe*, recently built by Messrs. Russell & Co. This vessel is to the order of Mr. James Nourse, London, and is the eighth constructed by Messrs. Russell and Co. for Mr. Nourse. After the launch the vessel was towed to Greenock to fit out in the James Watt Dock. She will afterwards load at Messrs. Aitken & Lilburn's dock, Glasgow, for Melbourne.

LAUNCH.—Irish.

Coasting Steamer.—On September 21st a new steamer built by Mr. Charles J. Biggar, Foyle Shipyard, Londonderry, was launched. Built to the order of Messrs. Singleton & Sons, Wirral Roller Mills, Birkenhead, she is to be used in the coasting trade on the Mersey. Her carrying capacity is about 120 tons, and she measures 80 ft. by 16 ft. 6 in. by 8 ft. Messrs. Dunsmuir and Jackson, Govan, are supplying the engines.

Lough Fisher.—On October 8th a screw steamer named the *Lough Fisher* was launched from the new shipbuilding yard of Messrs. MacIlwaine & Lewis (Limited), Belfast. The dimensions of the vessel are:—Length between perpendiculars, 168 ft.; breadth moulded, 25 ft.; depth of hold, 11 ft. 6 in.; long raised quarter-deck, bridge, and topgallant forecastle, with a carrying capacity of about 500 tons; fore-and-aft schooner-rigged; engines — direct-acting compound surface condensing, with cylinders of 24 in. by 38 in. diameter, 33 in. stroke; boilers made of steel, to be worked at 90 lbs. per square inch. The vessel is fitted with patent capstan windlass, three steam winches, and every appliance for the rapid discharge of cargo. The *Lough Fisher* is owned by Messrs. James Fisher & Sons, Barrow-in-Furness, and is the third steamer built by Messrs. MacIlwaine and Lewis for them. Miss Stelfox performed the ceremony of christening the new steamer.

LAUNCH.—Swedish.

White Bear.—On September 22nd a steamer of somewhat unusual construction was launched at Elsinore, Denmark. This vessel is built to the order of the Royal Greenland Commerce Company with a special view of being able to withstand a great pressure of ice. She is of wood, oak predominating, all the timber being of unusually heavy dimensions, and is covered wich an extra coating of oak and teak, with an intermediate layer of felt. Forward the vessel has an additional protection of iron strips, placed close to one another. She is rigged as a barque, and carries an engine of 250 I.H.P. The propeller is so constructed that it can be hoisted up through a well, when the vessel is under sail, and again lowered when steam power is required as a motor. The vessel's length between the perpendiculars is about 133 ft., its greatest outside breadth 26½ ft. The vessel carries a 22 ft. clink-built boat of oak, a 28 ft. whaling boat, a 15 ft. boat, and a steel boat 24 ft. long, which can be separated into several pieces. The vessel, which has been christened *Hoidlijärnen*—the *White Bear* — is built by the Elsinore Wood Shipbuilding Company, at a cost of about 225,000 kroner (or £13,000); boiler and engines, &c., are supplied by the Elsinore Iron Shipbuilding and Engineering Company, and the rigging will be completed at Copenhagen.

TRIAL TRIPS.

Baron Belhaven.—On September 23rd the new steel steamer *Baron Belhaven* went down the Firth of Clyde on her trial trip, preparatory to starting on her maiden voyage to Rangoon. The weather was fine, only a little foggy. The vessel, which is one of the largest built by Messrs. Robert Duncan & Co., Port Glasgow, was engined by Messrs. Duncan Stewart & Co., Glasgow, and is owned by Mr. Hugh Hogarth, Ardrossan and Glasgow. She is constructed of steel throughout, and her dimensions are as under:—Length, 300 ft.; breadth, 40 ft.; depth, 24 ft.; and gross registered tonnage, 2,400; with a deadweight carrying capacity of 3,500 tons. The *Baron Belhaven* has been built to the highest class at Lloyd's, under special survey, and fitted up with all the latest improvements for ensuring safety at sea and comfort for those on board, as well as the usual appliances for rapid discharge and loading of cargo. She is built on the cellular double-bottom system, and capable of carrying about 500 tons of water ballast. The vessel is also fitted with Walker's cherub ship's log, and the Atlas marine telephone—a new experiment for keeping up communication from the bridge to the ship's stern. She is fitted with triple-expansion engines of the newest design, the cylinders of which are 22 in. by 35 in. and 57 in., with a piston stroke of 39 in. Steam is supplied to the engines from two multitubular cylindrical boilers, with a working pressure of 160 lbs. to the square inch, capable of developing about 2,000 H.P. At the trial the engines worked up to fully 2,000 H.P., and showed a mean speed of 10 knots, with a consumption of coal at the rate of 14 tons per 24 hours—a development considered highly satisfactory to all concerned.

Malikah.—On September 23rd a new steam yacht, named the *Malikah*, just completed by Messrs. Ramage & Ferguson, of Leith, and built from the designs and under the superintendence of Mr. J. E. Wilkins, of Wivenhoe, for Mr. H. J. Barrett, of Langford Park, Essex, ran her trial trip, and 50·4 knots were registered by the log for four hours' continuous steaming, the mean number of revolutions being 113·26 per minute, developing 465 I.H.P., with a mean steam pressure of 146 lbs. per square inch, the consumption of coal being a fraction under 1¼ lbs. per I.H.P. per hour. The boiler is 9 ft. long and 12 ft. diameter, constructed of steel, and to work at 150 lbs. per square inch, and fitted with Brown's patent annular furnaces. The engines are triple-expansion, with cylinders 15 in., 24 in. and 39 in. diameter, and a length of stroke of 2 ft. A progressive trial, which was afterwards run on the measured mile, showed that the yacht could be driven a mean speed of 12·9 knots with 106 revolutions, 11·19 with 100 revolutions, and 10·15 with 90 revolutions. The speed obtained on the four hours' run is equal to about 14¾ statute miles per hour. Her principal dimensions are:—Length on load-water line, 144 ft.; length over all, 157 ft.; breadth, 22 ft.; draught of water aft, 10 ft.; tonnage, 310 Thames measurement. She is fitted with Harfield's patent capstan for both steam and

hand, and Duncan's steam steering machine. The latter is noiseless in its working, and in construction is a quadrant-shaped cylinder, with piston inside, to which steam is admitted through valves which are opened or closed by working the wheel from the bridge. It is the first machine of its kind that has ever been fitted to a yacht, and is so arranged that when steam is shut off it will work by hand power alone. A hand screw steering gear, designed by Mr. Wilkins, is fitted over the rudder-head, and at any time the bridge steering fittings can be thrown out of action and the vessel steered by the screw gear on the rudder-head. She is schooner-rigged, with two pole masts, and light and ventilation have been well thought of. The vessel has large accommodation. At the foot of the stairs leading from the deck-house is a small lobby, and a swing door opens from this into a serving room communicating by a lift to the cook's galley on deck. On either side of this room are the owner's and ladies' cabins, and opening off the passage forward the saloon are three state rooms and a linen closet, while at the end is the steward's pantry and cabin. Abaft the engines and boiler are a smoking room, two state rooms for gentlemen, and bath room. The captain's cabin is aft, with officers' mess room, engineer's cabin, and sterncastle with bunks for six men; and right forward is a forecastle with cots for eight men and two store-rooms. The boats, which include a 26 ft. steam launch, were built by Mr. Wilkins, at Wivenhoe, and the blocks, &c., were also supplied by the designer.

Ariosto.—On September 24th this fine steamer, built by Messrs. Russell & Co., at their Greenock yard, for Messrs. Robert Macandrew & Co., of London, and engined by Messrs. James Howden & Co., Glasgow, made the official trial of her machinery. The *Ariosto* is a sister ship to the s.s. *Tasso*, by same builders and engineers, whose successful trial we reported last month, also built for Messrs. Macandrew & Co.'s South American trade. The dimensions of the steamers are 320 ft. by 40 ft. by 27 ft. 6 in., and their tonnage 2,989 gross. The steamers are of a full model, built to carry 4,000 tons deadweight on a moderate draught. The engines are of the triple-expansion type, on Howden's patent arrangement, formerly described, having cylinders 23 in., 39 in., and 64 in. diameter by 42 in. stroke. Steam at 160 lbs. pressure is supplied by two single-ended boilers, 14 ft. 4 in. diameter by 9 ft. 4½ in. in length, having each three furnaces, 3 ft. 3½ in. mean diameter, the area of fire grate being 45 square feet, or 90 square feet in all. These boilers are, like those of the *Tasso*, worked on Howden's patent forced draught system. The high results obtained in the trial of the *Tasso* were more than realized in the *Ariosto*. The mean speed on two runs up and down between the Cloch and Cumbrae Lights was 13·31 knots per hour. The forced draught was worked at a much reduced air pressure to save continued blowing off at the safety valves, the supply of steam being more than the engines were able to use even with the fan working at a moderate speed. The whole performance of the engines and boilers was of the most satisfactory character, and amply confirmed the unequalled economy and efficiency of this system of forced draught. No trial of consumption of coal was made during the run with the *Ariosto*, but a trial of more practical value than can be made under the conditions of a trial trip has already been made by the sister ship *Tasso* on her first voyage. With 4,000 tons of deadweight on board, the voyage was accomplished at an average speed of 11 knots on 20 tons of coal per day, with an I.H.P. of 1,450—equal to a consumption of 1·28 lb. of coal gas per I.H.P. per hour. This consumption will be still further reduced, as it has been invariably found in every steamer fitted with this system of forced draught that after one or two voyages the consumption decreases, owing to the engineers and firemen gaining experience in the working of fires and air pressure. Messrs. Macandrew's representative, Mr. John Kennedy, London, under whose directions the two steamers have been built, again expressed his great satisfaction at the results of the trials of these steamers. The company on board enjoyed a pleasant day's trip in fine weather, and returned with the steamer to Greenock in the evening.

Fifeshire.—On September 24th the trial trip took place of the *Fifeshire* (s.), built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs. Turnbull, Martin & Co., Glasgow, with machinery by Messrs. Blair & Co., Stockton, to carry about 4,750 tons deadweight. The *Fifeshire* is fitted with Lightfoot's Patent Dry Air Refrigerating Machines, capable of supplying 100,000 cubic feet per hour, and with holds insulated for carrying about 100,000 cubic feet of dead meat. The steamer has also accommodation in poop for 60 first-class passengers, and will be employed between Australia and New Zealand and London. The machinery worked very satisfactorily. After the trial the *Fifeshire* left for London to take in her cargo.

Prospero.—On September 25th this steamer, which Messrs. David Rollo & Sons, Fulton Engine Works, have contracted to supply for the South Wales and Liverpool Steamship Company, of which Messrs. R. Gilchrist & Co., 21, Water-street, Liverpool, are the managers, went on her official trial trip. Messrs. Rollo and Sons have fitted her with a set of their triple-expansion engines, having cylinders 14½ in., 22 in. and 38 in. diameter respectively, the stroke being 27 in. The engines are of the three-crank type, having the valves in line over the shaft, the valve gear being the ordinary double eccentric bar-link arrangement. The eccentric straps are of gun-metal, and the gear has been designed with ample working surfaces, and is adjustable at every joint. The pumps are worked by links and levers from the centre-engine crosshead, this giving the maximum of room for overhauling. Steam is supplied by a large steel boiler, 12 ft. 6 in. diameter by 10 ft. long, having three of Brown's patent ribbed furnaces. The working pressure is 150 lbs. per square inch. There is a powerful donkey pump fitted in the engine-room, also a fire-pump which can be worked from the deck in case of need. For the handling of the cargo three powerful steam winches have been provided, steam for these being supplied by a large donkey boiler fitted in the main stokehold. The *Prospero* is a vessel of 900 tons, and is of the following dimensions:—165 ft. long, 25 ft. beam, and 12 ft. depth of hold. She has been built by Messrs. W. H. Potter and Sons, and has been constructed under the superintendence of Mr. A. M'Cracken, consulting engineer, South Castle Street. On her trial the vessel gave every satisfaction, her machinery indicating 550 H.P. at 100 revolutions per minute, the ship going 11½ knots.

Glenfield.—On September 26th the screw steamer *Glenfield*, of Stockton, left the graving dock at Cargo Fleet for her trial trip. This steamer is 2,127 gross tons, and is owned by Messrs. F. Binnington & Co., Stockton. She is the seventh vessel built for them by Messrs. Richardson, Duck & Co. She is a quarter-deck boat, with long bridge, extending almost to the forecastle, has four steam winches, and steam steering gear, and is supplied with all modern appliances for loading and discharging cargo. Her deadweight capacity is 3,100 tons on Lloyd's freeboard, and her measurement capacity is very large; hence she is particularly suited for carrying light cargo. Her engines, of the triple-expansion type, are by Messrs. Blair & Co., Limited, and worked smoothly, the vessel attaining a mean speed of 11 knots. She is commanded by Captain James Newdick, of Hull.

Argos.—On September 27th the new steam screw-tug *Argos*, which was lately constructed by the Abercorn Shipbuilding Company, Paisley, went on her trial trip on the Clyde. The speed which she attained was 12 statute miles per hour, which was considered highly satisfactory. She is fitted with compound surface-condensing engines, of 45 H.P. nominal, which were supplied by Messrs. Hanna, Donald, and Wilson, Paisley. The *Argos* has been built to the order of Messrs. M'Adam & Evans, of Rio Grande do Sul.

Bertha.—On September 28th the screw steamer *Bertha*, which was purchased some time ago by Messrs. H. S. Edwards & Sons, of South Shields and Howdon-on-Tyne, was taken to sea on a trial trip after having undergone extensive alterations and repairs, and having been restored, under Lloyd's special survey, to her original class of 100 A1 at Lloyd's. This vessel has had the compound engines removed and replaced by new tri-compound engines by the North-eastern Marine Engineering Company, Wallsend. The new engines are 21, 35, and 58, with a stroke of 39 in., and a working pressure of 160 lbs. The mean speed of four runs over the measured mile was 11½ knots, which was considered highly satisfactory, the engines running with smoothness and without hitch. The *Bertha* is a vessel 302 ft. long, 35 ft. broad, and 25 ft. deep. After the trial she was taken to Messrs. Edwards' yard at Howdon. The engines during construction were superintended by Mr. Menzies, of Newcastle.

Esperanca.—On September 28th a successful official trial trip at the mouth of the Mersey was made of the first of the two steamers, the *Esperanca*, the launch of which occurred a few weeks since. The vessel had more than her stipulated weight on board, and her speed, tested by several runs with and against the tide over the measured mile, was 12·4 knots, which was considerably over the contract. The engines throughout worked admirably, making 132 revolutions and developing 760 I.H.P. The vessel was remarkably free from vibration, and steered quickly and well, and generally came fully up to the expectations formed of her.

Australia.—On September 30th this new steel cruiser had a successful trial of her machinery. The vessel left the Nore at 10 a.m., and within a quarter of an hour she entered on her full-speed trial with forced draught, and from start to finish everything went most satisfactorily. The highest horse-power obtained was 9,130, and the average during the four hours' trial was 8,876. The *Australia* was built and engined by Messrs. R. Napier & Sons, of Glasgow. The *Australia* is a steel cruiser of 5,000 tons and 8,500 N.H.P., so that at her trial on Friday she largely exceeded the power contracted for. She is 300 ft. long between perpendiculars, 56 ft. in extreme breadth, and 37 ft. deep moulded. The ship belongs to the class which carry their protective plating outside, and which has this element of comfort, that the shell will burst outside the ship. In this case the armour belt protects the water-line all round, and consists of compound steel and iron plating 10 in. thick, made partly by Cammell and partly by Brown. Level with the top of the armour belt is a protective steel deck 2 in. thick, sloped down forward to the point of the ram to strengthen it for its work. All the machinery of vital importance, including the steering gear, air compressors, and electric machines, is under this deck. While these precautions are taken to keep all sources of danger from getting into the ship, to prevent her from being sunk in the event of being pierced, the under-water part of the hull is subdivided most minutely, there being no less than 130 separate watertight cells and compartments. Her armament will consist of two very long range 9¼ in. Armstrong guns, ten 6 in. guns of the same class, all mounted on central pivot Vavasseur carriages, eight 6-pounder and eight 3-pounder quick firing guns, and six torpedo impulse tubes. The machinery of the *Australia* marks an era in the navy. Messrs. Napier were able to show the Admiralty that they could, by substituting triple-expansion engines working with 130 lbs. steam pressure, give an increase of 1,000 H.P. and almost a knot more speed, thus enormously increasing the value of the ships as fighting machines, and that without increasing the total weight of machinery and coal, or occupying more space. The machinery consists of two sets of engines, each in a separate compartment, each set having three cylinders, the high pressure being 36 in. in diameter, the intermediate 51 in., and the low pressure 77 in., and all of 3 ft. 8 in. stroke. Steam is supplied by four steel boilers of the ordinary return tube style, working at 130 lbs. pressure, placed in pairs, each pair in a separate compartment.

Asturiano.—On October 1st this steamer went down the river for her official trip after having her machinery converted from the compound to the tri-compound system by Messrs. David Rollo and Sons, Fulton Engine Works, Liverpool. She has been supplied with new boilers working at a pressure of 150 lbs. to the square inch. The diameters of the new cylinders are 21½ in., 34 in., and 55 in. respectively, the length of the stroke being 36 in. The engines will exert a much greater power now than previous to converting, and it is stated that the engine-room has been reduced 2 ft. in length from what was considered necessary for the compound engines. In carrying out this conversion Messrs. Rollo and Sons have not added to the main framing, but have produced a triple cylinder three-crank engine occupying less space and on the same framing as a compound engine of about 200 less I.H.P. The engines gave every satisfaction, working with great smoothness when running full speed. The *Asturiano* is a vessel of 1,804 tons gross, she is 275 ft. long, 34·2 ft. beam, and has a hold depth of 24·8 ft. She is owned by the Atlantic and Eastern Steamship Company, of which Messrs. John Glynn & Son are the managing owners. The whole of the work has been carried out under the superintendence of Mr. George Hepburn, consulting engineer, of Liverpool.

Santanna.—On October 5th the steam yacht *Santanna*, built by Scott & Co., engineers and shipbuilders, Greenock, to the order of Mons. Louis Prat, of Marseilles, had her official trial. On the invitation from the builders a select party met at Wemyss Bay, there to join the vessel. The vessel's dimensions are:—length, 195·7; breadth, 24·1; depth, 14·25; tonnage (yacht measurement) 508 tons, and it has been built under Veritas Survey for their highest class. Four Nordenfelt guns have been fitted on the main deck. The cables are worked by a Napiers' steam windlass. A steam warping capstan by same makers is fitted aft, while Messrs. John Hastie & Co. have furnished the steam steering gear. The engines are of the triple-expansion surface-condensing type, having cylinders 17 in., 28 in., and 46 in. diameter respectively, with a stroke of 2 ft. 6 in., and the indicated horse power is 800 horses. The boiler is of steel, and is fitted with Fox's patent corrugated flues, and its working pressure is 150 lbs. The same skill, care, and regard for efficiency, combined with excellence of workmanship and beauty of finish, is carried out in this department as in the hull, and the whole forms, without exception, one of the handsomest yachts which has ever been built on the Clyde. The result of the four speed trials over the measured mile—two with and two against the tide—was most satisfactory, the average time being 4·17 min., showing a mean speed of 14 knots per hour. The vessel was then put upon a six hours' run, to test the consumption of coal, and showed a result of 1·4 lb. per indicated horse power per hour. At dinner the representatives of the owner expressed themselves extremely satisfied with the results of the several trials. The yacht proceeded to Greenock in the evening, and landed the party at the James Watt Dock, all much gratified with their day's outing.

Olive Branch.—On October 8th the *Olive Branch*, built by Messrs. Bartram Haswell & Co., Sunderland, and engined by Mr. John Dickinson, for the Nautilus Steam Shipping Company (Limited), made the official trial of her machinery. The *Olive Branch* is of the following dimensions:—Length, 300 ft.; breadth, 39 ft. 4 in.; depth, 28 ft. 6 in.; having a gross tonnage of 2,744 tons, and estimated to carry upwards of 3,900 tons deadweight on a moderate draught. The engines are of the triple-expansion type, having cylinders of the diameter of 23½ in., 38 in., and 62 in., with a stroke of 42 in. Steam at 150 lbs. pressure is supplied by two single-ended steel boilers, each being fitted with three of Fox's patent corrugated furnaces, and also with a patent furnace arrangement and a new system of induced draught by Messrs. W. A. Martin & Co., of London. The results obtained on the trial proved satisfactory. The entire performance of the engines and boilers fully confirmed the anticipations entertained of their efficiency and economy. No test of the consumption of fuel was made during the run, but this was apparently quite satisfactory. On completion of the trial the *Olive Branch* proceeded on her voyage to London to complete her loading, under engagement with the Council of India, for Rangoon.

Vascongada.—On October 8th the trial trip took place on the Clyde of the s.s. *Vascongada*, owned by Messrs. Ferguson & Reid, and built by Messrs. Alex. Stephen & Sons. This steamer has been built for cargo-carrying purposes, but is more completely fitted up than many vessels of a similar nature. Her engines are on the triple-expansion principle, with Messrs. Stephen's forced blast arrangement, and she is also supplied with Messrs. Muir and Caldwell's steam steering gear and with Sir W. Thomson's patent sounding machine. Her saloon is larger than that of most cargo steamers, and she has a few roomy and well-furnished staterooms. She is commanded by Captain Ewer, while Mr. Jackson, who was recently chief engineer of the *Great Eastern*, and who carried out a great many improvements in the machinery of that huge vessel, takes charge of the engines, mainly with the object of watching the working of the forced blast. During the trial trip the *Vascongada* obtained a speed on the measured mile of close on ten knots an hour. In the course of the run dinner was served by Mr. John Forrester. Mr. E. Kemp, consulting engineer to Messrs. A. Stephen & Sons, who occupied the chair, proposed "Success to the *Vascongada*," the toast being responded to by Mr. Fergus Ferguson. The health of "The Builders" was proposed by Mr. Reid, and responded to by Mr. Alex. Stephen, jun., the engineering partner of the firm. The *Vascongada* sailed the same night for Alexandria.

Bencroy.—On October 11th the new screw steamer *Bencroy*, constructed by Messrs. John Jones & Sons, of Liverpool, for Mr. Joseph Hoult, the managing owner of the Ben Line, was formally added to Mr. Hoult's fleet, and a trial was run from New Brighton to the bar and back. The principal dimensions of the vessel are:—Length between perpendiculars, 285·9; breadth (moulded), 38; depth 20·3; depth of hold from spar deck to floors, 25·5; gross registered tonnage, 2,516·86; nett registered tonnage, 1,666·92; and her hold capacity is 171,973 cubic ft. She has been designed to take large cargoes at a light draught of water, and will carry a deadweight of 3,500 tons. At the trial she passed down the Channel swiftly and smoothly, and in the run made an average speed of 10½ knots on an economical consumption of fuel. The *Bencroy* afterwards left direct for Newport, from which port, on completing her cargo, she sails for Grand Canary.

Thetis.—On October 11th the steam yacht *Thetis*, built by Messrs. Murray Brothers, Dumbarton, and engined by Messrs. Muir & Houston, Harbour Engine Works, Glasgow, for Mr. John Donaldson, Tower House, Chiswick, went down the Firth of Clyde on her trial trip, with a number of ladies and gentlemen on board. On arrival at Wemyss Bay the *Thetis* was put upon her speed trials,

and with a full compliment of coal and water on board—about 150 tons—she attained the mean speed of 12·3 knots. The engines throughout the trials made 127 revolutions with a displacement of 580 tons. The indicated power of the engines are 600 H.P. The length of the yacht over all is 180 ft.; breadth, 25 ft.; depth (moulded), 15 ft. 6 in.; and the tonnage, 490 yacht measurement. The engines are triple-expansion, with cylinders 14 in., 23½ in., and 36 in., by 27 in. stroke. The boiler is an extra large one, and gives 160 lbs. working pressure. The yacht is built of steel, is 25 per cent. over Lloyd's requirements, and is schooner-rigged. Internally she is divided into nine water-tight compartments with eight bulkheads, and is so arranged that if, although any two of the compartments were filled, she would still float. Each compartment is complete in itself, and instead of the water being taken aft to the engines the pumps are taken to the water, and each compartment is fitted with an ejector capable of ejecting 40 tons per hour, with the usual hand-pumps besides. The steam steering gear is specially arranged by Mr. Donaldson, the owner. Three of the compartments are fitted up as sleeping cabins, with the latest improvements. The length of the saloon is 14 ft. 6 in., and the full width of the ship 24 ft. She is lighted up throughout with electric light by Messrs. Muir, Mavor & Coulson, Glasgow. The yacht has been specially constructed under the superintendence of Mr. John Wilson, consulting engineer, Glasgow.

Britannia.—On October 15th the magnificent screw steamer *Britannia*, built and engined by Messrs. Caird and Co., Greenock, for the Peninsular and Oriental Steamship Company, went down the Firth on her trial run, with a large company of ladies and gentlemen on board. The *Britannia* is a sister ship to the *Victoria*, and has been constructed by Messrs. Caird and Co. in the short period of ten months. Her dimensions are:—Length on load water line, 465 feet 9 inches; breadth (moulded), 52 feet; depth, 37 feet; and gross tonnage, 6,267 tons. She is supplied with powerful engines on the triple-expansion principle, with all the latest improvements, and developing about 7,000 H.P. (indicated). The diameters of cylinders are 40, 60, and 100 in. respectively, the length of stroke being 6 feet in each. The engines of this vessel are guaranteed to give her an ocean speed of over 14 knots per hour, and burning 110 tons nett of coal per diem. The boilers are six in number (double-ended, and constructed entirely of steel), having 36 furnaces, and adapted for a proof pressure of 300 lb. per square inch. She has besides a three-furnaced auxiliary boiler for general purposes. Her water tanks, structurally built in compartments, are designed for safety and for adjusting the trim of the vessel under varying conditions of loading or when passing over a bar. Being a large freight carrier, she is equipped with all modern appliances for loading and discharge of cargo, including several hydraulic hoists and cranes by Sir William Armstrong and Co. With regard to her passenger accommodation, she is designed to carry 154 first-class saloon passengers, 156 second-class saloon, and 460 third-class passengers. Every attention has been paid to the ventilation, and in this vessel a mechanical system has been adopted by which fresh air is forced through the ship and the vitiated air extracted. The ship will be lighted throughout by electricity, for which purpose she has two engines distinct from other work, and duplicate dynamos, furnishing power for 500 incandescent lights. Arrangements are made for the carriage of a very large supply of fresh water, in addition to which the vessel carries two Normandy's condensers. There is plenty of bath accommodation and other effective sanitary arrangements. Every provision has been made to ensure the safety of the passengers, crew, and ship. The arrangement of boats is ample to meet all requirements. The structural designs and general arrangements of the vessel have passed the Director of Naval Construction, and her name has accordingly been placed on the Admiralty list for employment in case of need as a fast cruiser. In that connection she could carry 1,200 soldiers, and, in case of national necessity, she could accommodate on her main and lower decks 2,700 men. It may be mentioned that the vessel is also fitted with one 70,000 cubic feet per hour delivery compound duplicate refrigerating machine, weighing 60 tons, supplied by the Haslan Foundry and Engineering Company, Derby. The *Britannia* ran the measured mile, when she attained the speed of over 16 knots per hour.

Drummond Castle.—On October 22nd the *Drummond Castle*, the second of the Castle Line of Royal Mail Steamers which has been tripled by Messrs. T. Richardson & Sons, of the Hartlepool Engine Works, left Hartlepool for a full speed trial of her new machinery. The original engines were built by the celebrated Clyde firm, Messrs. John Elder & Co., in 1881, and were of the two-crank compound type, having cylinders 51 in. and 88 in. diameter, with a stroke of 4 ft. 9 in.; these have been converted into three-crank triple-expansion, with cylinders 33 in., 55 in., and 88 in., steam being generated in three very large double-ended boilers at a pressure of 150 lbs. During the twelve hours' trial the engines worked most satisfactorily, after which the ship was taken over by the representatives of the Castle Company and left for London, where she arrived, after having made a very successful passage. Besides the alterations to the main engines, a large refrigerator has been fitted, by means of which the passengers will be supplied with fresh meat, fish, milk, &c., throughout the voyage. All the cabins, which were damaged by fire in London, have also been renewed by Messrs. Withy & Co., of the Middleton Shipyard, and yet the whole of this work was accomplished in the short space of fourteen weeks. Messrs. Richardson & Sons have been advised by the Currie Co. that the saving of fuel on the *Grantully Castle* has been 34 per cent. on the voyage from London to Cape Town, and this great success has resulted in a decision to place their finest steamer, the *Roslyn Castle*, in Messrs. Richardson & Son's hands to triple, and she will arrive in Hartlepool early next year. This great saving in fuel has also been accomplished in the Union Co.'s s.s. *Trojan*, which has just returned from her third Cape voyage. It is an interesting fact that the *Drummond Castle's* engines complete the large total of 30,000 I.H.P. which has been manufactured by Messrs. Richardson & Sons since last January, and is the greatest output they have ever recorded in so short a space of time.

Kupluis.—Recently the new steel screw hopper dredger *Kupluis*, built by Messrs. William Simons & Co., Renfrew, for the Bombay Port Trust, completed on the Clyde the trials of its dredging and steaming capabilities, with the result that the requirements of the specification have been considerably exceeded —a fact which cannot but be gratifying to the owners and builders alike. There were present at the trials a number of well-known harbour-engineers and other gentlemen interested in this particular class of work. Afterwards the *Kupluis* was fitted out for the voyage to Bombay, and left Greenock on the 30th September for that place *via* Suez Canal.

Svea.—This Swedish ironclad, constructed by the Lindholmen Engineering Works, of Gothenberg, had her trial recently. The *Svea*, which is the first modern ironclad possessed by Sweden, is of the following dimensions:—Length between perpendiculars, 75·7 metres; width, 14·8 metres; draught of water, 4·97 metres. Her displacement is 3,000 tons. The armament consists of two 25·5-centimetre Armstrong breechloading guns, mounted in the citadel; four 15-centimetre Armstrong M-83 guns, on Vavasseur carriages, mounted on the upper deck, two on each side abaft of the turret; two 38-millimetre Nordenfelt M-84 guns in the stern, and four 25-millimetre machine guns on the lower deck. The vessel is also fitted with torpedo apparatus, search light, &c. The citadel reaches below the water line, whilst the armour from stem to stern is 5 centimetres in thickness. The vessel has only one mast for machine guns, and no rigging. She is built of Motala Bessemer steel, but the transverse armourplates were manfactured at the Creusot works. The average speed at the trial was 14 knots per hour.

Waverley.—This vessel, whose machinery has recently been altered to the triple-expansion system, was taken on her trial trips last month. She formerly had boilers working at 80 lbs. pressure, and with cylinders 41 in. and 78 in. diameter, and the alterations have involved the substitution of new boilers of steel carrying steam at 160 lbs. pressure, and the addition of two new cylinders placed on the top of the former cylinders. On the trials the engines developed nearly 2,000 H.P., and worked with remarkable smoothness at 64 revolutions per minute. It is expected that a great economy in fuel consumption will result from the alteration, which has been carried out from the specifications of Messrs. Hannery & Baggallay, consulting engineers, of London. The s.s. *Waverley* belongs to Messrs. Williamson, Milligan & Co., and with her sister ship the s.s. *Peveril*, is well known in the Eastern trade.

According to the Berlin Bureau of Statistics there are in the world the equivalent of 46,000,000 H.P. in steam engines, 3,000,000 being in locomotives. In engines other than locomotives the United States comes first with 7,500,000 H.P.; England next, with 7,000,000 H.P.; Germany, 4,500,000 H.P.; France, 3,000,000 H.P.; and Austria, 1,500,000. Four-fifths of the steam engines now in operation are said to have been built within the last 25 years.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—Although I am only a "deck" hand, yet I have for years past been a subscriber to your magazine on account of the valuable and interesting information to be obtained therefrom. Naturally I have read the correspondence *re* "The Position of Marine Engineers," and as only a unit amongst the "deck" hands I have often been considerably pained at the tone used towards us, as a body. In your number of July last there is a letter from chief engineer Mr. R. F. Taplin, and a more manly, honest and straightforward piece of writing I have never had the pleasure of reading. He strikes at the root of the whole business, and if only the majority of sea-going engineers would take the same sensible view of the "deck" hands as he does, many vessels where discord reigns supreme would be amongst the happiest ships afloat. I am happy to record that during some ten years' service in one of the crack mail services I could reckon amongst my best friends some of the engineer officers.

I am, Sir, yours truly,
FRANZ. K. THIMM, R.N.R.
(Master Mariner),
Commander in the Irrrawaddy Flotilla Co., Burma.

MANDALAY, UPPER BURMA,
Sept. 1st, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—Seeing that this discussion is the result (as "Chief Engineer" points out in your August number) of my article on "Crank Shafts," I think I may be excused for offering a few remarks on the subject under discussion. I do not intend to defend myself from the attack made by "Chief Engineer," his reading of my article and consequent comments on it being rather too absurd to require any reply. I regret deeply that this, and other writers, should have indulged in such expressions as have appeared from time to time during the correspondence; but I have no doubt that many of your readers will rejoice with me that much of the bright and hopeful side of our profession has been brought out, and I hope permanent good will result from it. Much as some of us complain of, and not without cause in many cases, I have the greatest confidence in the steady, gradual recognition, and advancement of our position. I have no doubt whatever (and I may lay claim to being in a position to judge in this matter) that the day is not far distant when there will be *one* master in a steamer, and that one will, of necessity, be an educated mechanic. I do not, however, agree with some of your correspondents that the engineer will have to take his "watch on the bridge," neither do I think that the "mariner" has had his day and is done with. My own view of this matter is rather that with iron and steel steamers, practically mastless, and filling up more and more with machinery and mechanical appliances, the most important offices necessarily fall to the engineer, and that this is gradually being recognized by the shipowner.

The present arrangement of placing a man who has no scientific training in a position which really gives him control of engines and boilers of ever-increasing power and perfection, is too absurd to continue. I believe, however, that the navigation of a vessel will always give employment to two or three men who should be experts in that comparatively simple attainment. Why the entire control of the ship and ship's business should be in the hands of a man whose speciality is navigation, it is rather difficult to find out, unless we allow this to be a relic of the past, when ships were "ship-shape," and their efficient management required genuine seamanship, and the best training for a master was that of the sailor. Things are greatly changed from that now, and the training required is mechanical. The accomplishments now required in a shipmaster appears to me to be a knowledge of iron shipbuilding, engine and boiler making, electricity, hydraulics, applied-mechanics, and navigation, together with several other subjects. Now it appears much easier for an engineer, who has a knowledge of all these except navigation, to take up the latter, than for a mariner, who is trained only in navigation, to take up the rest, or to efficiently discharge his duties without them.

Or, in short, I may venture the opinion that the shipmaster of the future must be a man with a scientific education. I have spoken of engineers as being trained in a number of subjects, none of which it will be disputed are, if not absolutely necessary, very useful to us; but I know well that we are as a class open to the charge of being very ignorant of many of them, and while I reserve my opinion as to the benefits to be derived from the "Union" until we have seen the line of action adopted, I would recommend constant individual action in the matter of self improvement, and I would urge all contributing to this correspondence to avoid all personalities (I had almost said brawling) and to let the discussion run rather in the direction of mutual improvement, for I think most of your readers will agree with me that, whatever united action may do for us, as we personally rise and improve in knowledge and self-esteem, so will we rise as a class and in the esteem of others. I sincerely hope that much of the power and energy of the Union will be applied to educational purposes.

I should like to add a word or two on behalf of the sailor: While I have found much that is low, and depraved, and narrow, amongst that class, I do not think they are worse than might be expected judging from the circumstances they have been placed in from an early age; and at the same time I am personally acquainted with many who might fairly be described as gentlemen. In conclusion, I am sorry to say I have not followed this discussion closely, and if I am going over ground which has already been covered, my transgression is due to this circumstance.

Yours truly,
T. W. BARRON.

HARTLEPOOL, *September 23rd*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—Will you kindly permit a station hand to say how much we are indebted to you for opening your columns to the publication of so many excellent letters on the above subject? To those who, like myself, are sweltering in a tropical temperature, such letters as "Excelsior's" and the Hon. Secretary's come as a pleasant refresher. After the latter's clear and concise statement as to the objects and probable attainments of the Union, it may seem ungracious on the part of anyone to offer anything in the shape of carping criticism; but no doubt, if asked, an "Engineer of Mailship" could testify to the difficulty experienced in persuading some of his *confrères* to aid the Union with their moral and pecuniary support. It is indeed difficult to imagine why anyone should not join at once, and to a less cynically disposed person than myself, a great deal of amusement (not unmixed with sensations of a different sort), may be derived from listening to the lame and impotent arguments adduced in support of their untenable position.

We are all unhappily acquainted with the "perfect" type of engineer, who, faultless in all things, and sheltered behind his own immaculate superiority, never hesitates to sit in judgment or cast a bit of dirt at a brother engineer, who, through force of circumstances, may be placed in a position of some ambiguity, and less happily situated than his more fortunate mentor.

From such persons may be expected a positive disapproval, or at the most a negative support. Careful always to point out that part of your editorial where a fear is expressed that the Union may bear the same relation to the shipowning class as many trade unions do to other trades at present, he hints the future possibility of the Union being a "cave of Adullam" for refractory or inefficient members; but no doubt the Executive will soon make the fact apparent that none such will be taken beneath the Union's sheltering wing, and even-handed justice dealt around will be part of their platform, so that both shipowners and engineers alike may be justified in placing every confidence in the committee's decisions. Just allow me to remind "Engineer of Mailship" that engineers of mailships do not enjoy a monopoly of social status as his letter seems to imply, when he urges them not to allow selfish motives to debar them from contributing to the necessary expenses of such an undertaking. In the company I have the honour to belong to, though the wages, and generally the accommodation, is good, yet our treatment by the deck department is far from satisfactory, and calls for immediate redress. Considering that the directors are business men, and as such are usually disposed to recognise the importance of our services, it is strange they do not disregard the opinions of

their resident deck advisers, and voluntarily improve the position of the men they depend upon so much for the efficiency of their ships.

But to a certain extent the attitude of the deck department is explainable, considered in the light of the position assumed by some of the chief engineers in this company, who, so far as being in touch with their juniors, might as well belong to the other department. No one will complain that they do not make the "second" or the others their confidants, considering that on a long voyage it is highly necessary they should be in a position to enforce the strictest discipline; but neither is it necessary or desirable that they should become the humble associates of (shades of Watt and Rankine!) a fifth or fourth mate.

No doubt, in the interests of the company, there should be shown a mutual politeness and courtesy by both departments, but considering the systematic snubs and insults heaped upon our cloth by the "deck ornaments" (so artistically touched off by our Hon. Secretary), it is little wonder the juniors notice with contempt and amusement this anomalous combination. Who can properly estimate the lofty condescension and patronage they extend to the "chief mechanic?" for, be it known from sundry hints and innuendoes, our deck ornaments are not distantly connected with the aristocracy (albeit the relationship is purely apocryphal), and when they require the chief engineer some such playful expression as "Jock" is thought sufficient, or the prefix of "Mr." is deemed a superfluity; and yet such a chief seems to consider himself highly honoured when the frequently proffered hospitality of his cabin is accepted by any junior deck officer, knowing full well that such a relationship between—say a fourth or third engineer and a chief officer is too phenomenal an occurrence to have come within the range of our observation—the deck people know at least how to conserve their own interests.

I will not, however, occupy your valuable space by dwelling upon what may only be the latent snobbery of a limited number, who, it is to be hoped, occupy an unique position in the profession; but as sure as any axiom in Euclid is the old truism that "familiarity breeds contempt," and on this hypothesis is explainable the cool way the duties and responsibilities of the deck department are shifted to the shoulders of the engineers, thanks in many cases to the pliableness of the chief engineers, whose duties, like those of his juniors, are quite enough already where electric light, refrigerating gear, and hydraulic, are in daily use.

So far from the grievance being wholly sentimental, I have only to ask your readers to consider the number of the cases where engineers in charge of the above-mentioned gears have been replaced by firemen, who, though quite capable of oiling round at sea, are of no use in port, the burden of work falling on the engine-room staff; and it may interest your readers who are studying the evolutionary development of "greasers" towards their full maturity as engineers, to know that in some mail steamers may be seen one specimen at least of the genus "shovel" dining in the mess-room after the engineers are finished, a position no more anomalous than would be that of the quartermaster who would assert his right to take a watch on the bridge, or dine in the saloon with the mates. How far these regrettable facts are due to the indifference of engineers themselves is for your readers to judge; the class of men who seem to bring in a true bill against their fellow workers for every fault conceivable is only a minority, though such stock phrases as "I told you so," and "Engineers are their own enemies," etc., are adhered to with priggish pertinacity, and I hope to see the Union effect a change, or at all events modify the sentiments of this class of society. One suggestion and I am finished. As yet it is only through the medium of your valuable paper that foreign station men have become acquainted with the formation of this Union, and if the Hon. Secretary could arrange to send a few pamphlets, and if possible, cards of membership, to say, Bombay and Calcutta and this port, he might safely count on an increased foreign membership. That it will be for the direct benefit of every marine engineer to join this Union admits of no doubt, and to mailship men quite as much a benefit as any other branch of the mercantile marine; our best wishes are for its lasting success. Should you kindly find space for this letter, please accept the thanks of an

EASTERN MAIL COMPANY'S ENGINEER.

HONG KONG, *1st August*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—It is with regret that I see such a bitter controversy carried on between "Excelsior" on the one hand and "An Uneducated Engineer" and "R. J. Cope" on the other. After a careful perusal of "Excelsior's" letter, I fail to see that such an onslaught should have been made on it by the two latter, and also that "Excelsior" should have taken it up in such a sarcastic manner; but I presume "Excelsior" sees that the rising generation of engineers will be a better educated class of men, and the responsibilities heavier, as it is very plain that education is growing with rapid strides throughout the country, and also the responsibilities of an engineer increasing; and there is no doubt the present examinations will not be so severe to them as to those of the past, hence, no doubt, "Excelsior's" reason for advocating the raising of the standard of examinations; but whether inorganic chemistry, &c., is the right direction or not might be a matter of opinion. There is another point I think would be deserving the attention of the Committee of Marine Engineers' Union which ought to be included in their legislative efforts, viz., ship masters occupying the position that ought only to be held by certificated engineers as superintendents. I know of several who have the power to put their veto on the necessary requirements of the engineer in charge. In one case a friend of mine, requiring a pair of connecting-rod brasses (top end) was refused them, although the ones then in use had to be put up in a number of pieces, and very thin at that; but on refusing to go in the ship, the brasses were forthcoming. And in another case the ship's husband (as they are termed) went into the boilers along with the Board of Trade surveyor, and began to tell him they were in splendid condition, &c., notwithstanding the surveyor found it necessary to reduce the pressure. Now I think such men ought to be prevented from having the power to veto the necessary requirements of an engineer, as it is an injustice to us, and against the shipowners as well. It is now with pleasure we turn to the report of the Hon. Secretary Marine Engineers' Union, and that he assures us that it is gathering strength daily; and I earnestly entreat its members not to turn it altogether into an aggressive Union; but as "E. M. S." suggests, one for mutual improvement, where discussions might be held, and opinions elicited on the various improvements now brought out.

I should suggest, where a difference of opinion occurs, that no such sarcastic language as some of your late correspondents have indulged in (for instance, telling a man his grammar and French, &c., is bad) should be allowed, as it would deter many a man from giving an opinion on many subjects he might be well qualified to speak on in a practical way, but may not be able to express himself in grammatical form; and if such bitter controversy should occur, I hope it will be severely checked, as it would not enhance that unanimity that should exist, and I venture to predict it would be the means of a falling-off of its members, and consequently possible failure of the Union, instead of which I hope we shall have a strong and well-organized one; and if carried out on the lines of "E. M. S.," it will be an undoubted benefit to marine engineers of all grades. When I say we, I hope to become a member of it on arrival home, and I trust not a sleepy one at that, as it behoves every one of us to use our utmost endeavours to make it a success.

In conclusion, I now offer my sincere thanks to you, Mr. Editor, for your kind courtesy in opening the columns of your valuable journal for the discussion of our grievances, also your kind remarks and good wishes for the success of the Marine Engineers' Union.

I remain yours truly,

HARTLEPUDLIAN.

GENOA, *7th September*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—Since I last wrote you I have received quite a number of letters from engineers belonging to ports where there have been neither agencies nor branches of the Union established as yet, saying that if a deputation could be sent to address open meetings of engineers in these places, and tell them all about the Union, the membership would be greatly increased, and branches could be opened by this means; and in some cases a deputation has been asked for. I have replied to these correspondents singly, but as I fear there are many others who may have the same opinion, it will save them the trouble of writing if you will kindly allow me to state for the information of engineers in general that there are no means at the disposal of the Executive Committee for complying with such requests. The Union is a purely voluntary movement, and seeing that it has provided the means for improving the position of *all* ranks of marine engineers, it cannot, surely, be expected that the executive are to send deputies to every seaport to *urge* engineers to avail themselves of such an opportunity. The circulars so freely distributed from this office give ample information as to the objects, operations and advantages of the Union, and it remains with engineers *themselves* to take the preliminary

steps if they desire to become members, or have a branch opened in their districts. It is only necessary to send in a petition to the executive, signed by twenty certificated engineers, residing in or trading to and from a port, to have a branch opened there forthwith, and, as at the opening of it all ranks of engineers are invited to be present, an opportunity is then afforded of asking questions of the deputation present regarding any matter connected with the Union or affecting the general interests of the profession.

I do not consider it necessary to say more upon this subject, as I believe my brethren know a good chance when they see it, and do not require any persuasion to embrace it; but I may mention that willing as the executive are to exert themselves for the general good, they are precluded by its constitution from applying any of the funds of the Union towards sending a deputation to any seaport merely for the purpose of explaining its objects or advantages, and should they unwisely do so, any individual member could call upon them and legally compel them to refund the money thus expended.

The anticipations shadowed forth in my last as to new branches being opened have now been fully realised, the important seaport Sunderland having now a flourishing branch that will shortly be accommodated in suitable premises in the best part of the new town; and Hartlepool having in two days got up and signed a petition with more than the requisite number, which, I am told, could easily have been doubled, a branch will be opened there on Monday the 31st inst. Two other ports are also in correspondence with a view to following their example, and altogether there are evidences that the Union will be generally adopted by engineers in much less time than was at first estimated. There have been some valuable accessions to its numbers lately, and applications are flowing in much more rapidly within this last month, so that there is every reason to be grateful for the success that has already attended our efforts. I would like to address a few words to your readers upon the vital importance of isolated and local societ'es c1sting aside all local prejudice and amalgamating with the Union, but I mu-t defer this subject for the present, having regard to the space already occupied.

With best thanks for your unfailing courtesy,

I am, &c.,

THE HONORARY CHIEF SECRETARY,
Marine Engineers' Union.

91, Minories, London,
October 23*rd*, 1887.

THE MARINE ENGINEERS' UNION.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—In the "Editorial Notes" of your issue for March there appeared a preliminary announcement regarding the formation of the "Marine Engineers' Union."

As it is now eight months since this announcement was made, and as, from the flourish of trumpets to which we were treated on its formation, the "Union" does not appear to have made that solid progress one might naturally expect it to have made in that time, I should, through your columns, like to ask one or two pertinent questions respecting the same.

What other officials, "Honorary" or otherwise, are there besides the "Honorary Chief Secretary?" Who is the treasurer? Are the accounts audited? And, if so, who are the auditors? Has a half-yearly statement of income and expenditure yet been prepared and laid before the members? Have any papers been read and discussed, or other steps taken to intellectually raise the members a step higher than they were before the formation of the "Union?"

I ask these questions because, so far as I can ascertain, the "Honorary Chief Secretary" appears to fill all the offices that exist in connection with the "Union," and not knowing anything of his qualifications for the various posts I am naturally rather sceptical as to whether he can fill them all simultaneously and satisfactorily to the best interests of the "Union."

I have heard a rumour, Sir, never mind from what quarter, that our old and tried friend THE MARINE ENGINEER was in some way connected with the "Union," and though I flatly contradicted the rumour on the spot, yet I should like to have an authoritative denial from you.

Not having a copy of the rules of the "Union" by me I should also like to know if it is expressly forbidden for one member to give testimony either in favour of, or against, another member in search of a post. If this is so, and I think my informant would not mislead me, then I say the "Union" is nothing more or less than an attempt to level up all members of our profession, good, bad, and indifferent, and totally irrespective of merit. Surely this is not the way to raise the status of the profession.

Without in any way wishing to disparage the "Union" as it now exists, I maintain that it does not adequately uphold the honour and interests of an honourable and influential profession, the members of which are numerically equal to those of any other profession.

What I should like to see in the higher interests of the profession would be an institution founded on, say the lines of the Naval Architects or Mechanical Engineers, with a properly appointed president, vice-presidents, members of council, treasurer, auditors, and a paid secretary, who should devote his *whole* time to the interests of the institution.

As a member of one of the institutions that I have named, and an associate of the other, I can tell you, Sir, that we should as soon think of asking the owners to appoint an "Honorary Chief Engineer" to, say, the *Umbria*, as we should think of asking any gentleman to devote his whole time to the interests of the institution without remuneration.

Should such an institution ever be founded I have not the slightest doubt but what it would soon be joined by, and receive the hearty support of, marine engine builders and owners as well, for from what other source could these gentlemen receive such valuable information regarding the merits and demerits of the machinery respectively built and owned by them as from the officers in constant charge of it?

No one who has attended the summer meetings of any of the recognised institutions can doubt for a moment the vast amount of benefit these excursions, inspections of works, yards, etc., has conferred on one and all participating in them, and I am confident that once a Marine Engineers' Institution becomes a recognised fact the members thereof will be quite as heartily received at the various manufacturing establishments as those of any other institution.

I must beg the "Honorary Chief Secretary," who is a perfect stranger to me, not to think that I have written out of personal animus to him, as far from it, I admire him for the efforts he has made, though at the same time, having the best interests of the profession at heart, and desiring above all things to see its true advancement, I cannot help but think his efforts have been made in a wrong direction.

Apologising to you for the length to which this has run, and thanking you in anticipation,

I remain, Sir, yours obediently,

M. I. M. E. & A. I. N. A.

[Our correspondent was quite right in flatly contradicting the rumour as to our connection with the "Union," as the MARINE ENGINEER is in no way whatever connected with or responsible for the "Union." At the same time we may state that our columns have always been open to it and will continue open to all that may be deemed of benefit to Marine Engineers.—ED. M. E.]

FORCED DRAUGHT.

To the Editor of THE MARINE ENGINEER.

SIR,—In your last number, you published a letter on this subject from Mr. Howden, who has now been before the public for some years as the inventor of a system of forced draught for boilers, which has been adopted in several vessels of the mercantile navy. He has read papers on the advantages of forced combustion before our scientific institutions, and has contributed many interesting articles on the same subject to the professional journals, and is rightly considered one of the few great authorities on this question. But like most other great men, Mr. Howden has allowed his ideas to drift into one groove, outside of which he believes that no good can exist; and it would appear from his letter that those persons who do not fall in with his opinions, and pronounce his plan to be the only feasible and practical one, are scarcely worth the trouble of noticing.

The remarks about the performance of the *Ohio* that appeared in the article of your September number, would probably have never been written had not such glowing accounts of the results of the official trials of this vessel been published in all the engineering papers. In the *Ohio*, Mr. Howden, I believe, undertook to bring the consumption of coal at full power down to 1·23 lb. per I.H.P. Now, with the present type of marine boiler, supplying steam to triple-expansion engines, this consumption is not very wide of the theoretical minimum limit, and as in

engineering a difference generally exists between the results obtained in practice and those theoretically calculated, the fact of the published reports giving a near approximation to the theoretical limit, aroused a suspicion that an error had perhaps been made in some of the calculations. This suspicion has been more than confirmed by the results obtained in several runs of the *Ohio* across the Atlantic. Mr. Howden gives as a reason for the consumption being rather high during the first voyage, that the fans broke down time after time. Now these same fans were large enough apparently to produce the results quoted on the official trials; but yet, after the ship had been at sea a few days they broke down, so Mr. Howden says. They were made by a firm whose reputation is very high for this class of machinery, and there must be, therefore, some cause for them breaking down with this system of forced draught, when fans designed on the same lines and proportions by the same firm have worked with the closed stokehold system for years without giving trouble. The cause is not far to seek, for with Mr. Howden's plan there are obstructions to the escape of the gases from the furnaces which do not exist in the more popular plan, and which become more obstructive when choked with soot. When everything was clean about the boilers, the fans were capable of doing their work; but after a few days' steaming a much greater pressure of air was necessary to produce the same draught through the fires, and the fans were, no doubt, driven considerably beyond their proper working speed to obtain this extra pressure, with the result that Mr. Howden mentions. However, the fan gear has been now made that it cannot very well break down, and another run has been made by the *Ohio* across the ocean. The weather was very good. The best picked Welsh coal was alone used, and every measure was taken to obtain the best possible results during the trip; but with all this, I believe the consumption of coal per I.H.P. under these most favourable conditions was 1·5 lb., or considerably above that reported to have been obtained on the official trials.

Mr. Howden makes much of the fact that the closed stokehold system has not been adopted to any great extent outside the Navy. One great reason for this is, that forced draught has been introduced into scarcely any other ships than those of the Navy, and his remarks, therefore, tell equally against all systems. It is pretty well known in engineering circles that the results obtained in the *Ohio* would decide as to the system of forced draught to be used in several important ships now building; and as these vessels are now to be fitted with closed stokeholds, either the *Ohio* has not turned out the success that was expected, or the owners and engineers of the new vessels must belong to the class of fools referred to by Mr. Howden in his letter.

The writer of the articles on "forced draught" has had some practical experience with marine boilers worked under forced draught, and he fails to see in what point, either for economy, efficiency, or endurance, Mr. Howden's plan would prove superior to the other in similarly proportioned boilers.

The rate of combustion in the *Ohio*, as shown by 22 I.H.P. per square foot of fire grate, is a very good one, and Mr. Howden is to be congratulated on it; but, during the present month, a warship built on the Clyde for a foreign Government gave identical results on her trial, with an air pressure of one inch of water only in closed stokeholds. With boilers, in which the heating surface bears a very large proportion to the grate area, such as exists in the *Ohio*, it is highly probable that they could be worked under the closed stokehold system for a much greater period than under any other.

In conclusion, I may add that I, in common with many other engineers, have been trying to ascertain (but without success) in what way the laws of nature referred to in the concluding paragraph of Mr. Howden's letter favour his plan, and are set at defiance in that system of forced draught, which recent events justify the writer in repeating is "the only one that seems to hold its own."

I am, Sir,
Yours faithfully,
THE WRITER OF THE ARTICLES ON FORCED DRAUGHT.

October 20th, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—Being interested in the application of forced draught to marine boilers, especially in warships, and not finding my experience of the closed stokehold system altogether agrees with some remarks in your articles of your September and October issues, I venture to offer some suggestions upon them.

Generally speaking, you adduce the following as being among the advantages to be gained by a closed stokehold with forced draught, as compared with open stokeholds, and natural draught. Normal temperature, pure air, greater comfort in working and preferred by the stokers, use of inferior and cheaper coal, and smaller and thinner tubes. Incidentally you also suggest, less exposure to rheumatism or kindred complaints, owing with natural draught, to standing under the air shoots to get cool, and you associate with the name of Mr. McFarlane Gray, a gentleman whose fertile witticisms are often puzzling unless one knows if he is in earnest or jest, the suggestion that keeping up steam with forced draught is easier work.

In argument against the system, you say the stokehold temperature under ordinary natural conditions is very great, as a consequence of the arrangements necessary for forced draught. But surely the temperature is not very much, if any, greater in a warship stokehold with these fittings than it would be without them, since all doors can be thrown open and admit practically as much air as if they were absent, is it not rather that an immense advantage of having fans handy is found with the stokehold open, especially in hot climates, in running the fans slowly for ventilation and cooling purposes only. It is extremely easy to do this, and need not in any case so affect the combustion as to render it difficult to keep steam from blowing off, even with dampers on first notch, and I believe you will find the fans so used under ordinary steaming wherever they are fitted.

I do not see how the temperature in a closed stokehold can be considered normal when the air is in a constant state of circulation, and has a temperature under the fans of a cold draught, and at other parts of from 84° to 93° F., or how the air can be pure when in addition to its ordinary nitrogen and oxygen it has combined with it a large element of coal or ashes dust. This soon becomes occularly apparent by the rapid change of colour in the stokers, and painfully so by the effects on their eyes, which are soon inflamed to redness and soreness. I have heard that more stokers have suffered with weak eyes since forced draught was introduced than before, and I certainly never heard a stoker support the system on the score of its comfort in working. Personally, I would rather risk rheumatism in an open stokehold, where if the temperature is somewhat higher, it certainly more approaches uniformity than in a closed stokehold, where you become a depositor for coal dust, and subject for coolness sake to be gradually refrigerated by standing near the currents of cold air. It may be interesting to note that on the steam trials of H.M.S. *Benbow* the stokehold temperature when closed varied from 84° to 93° F., and when open, from 92° to 98° F., not a great balance in favour of the former system. If by inferior coal, one may understand small coal, I fear its use can never be economical with forced draught, as the amount carried up the chimneys unconsumed would be far greater than at present, while it is deserving of mention that one disadvantage of a forced combustion is the necessity for iron tubes and the abandonment of brass tubes, owing to the greater heat, and at a loss of the efficiency given by the better conducting power of the latter. As to the easier work in keeping up steam; well—on H.M.S. *Rodney* the coal consumed per hour on the official trials was a little over 7 tons with open stokeholds, and nearly 11 tons with closed stokeholds. In other ships, the proportion is about the same, and would also remain so, under ordinary service steaming; surely it cannot be supposed that less work is involved in shovelling on the former amount than the latter. My experience of forced draught stoking is that it is far harder work and more prostrating, than with natural draught, and certainly more unpleasant.

This letter is already long, or I would like to refer to Mr. Howden's system, in which many of the objections I have named are absent, but I may perhaps mention one point; in your second article you say the stokehold air heated by radiation is beneficial, when, with a closed boiler room, its only egress is through the furnaces where its higher temperature promotes quicker combustion; while in commenting on the Howden system in your first article, you do not see how heating the air to a temperature of 200° before it enters the furnace can affect the combustion economically. It ought to be remembered that the Howden system is intended for permanent use with the view to economy of fuel, while the warship closed stokehold system is only for occasional use, practically regardless of consumption.

In conclusion, may I suggest that the closed stokehold, perhaps more than any other system, is still on its trial. In the navy we know its use has been limited, and only over short periods of time, but even this has told us of burning of firebars, rapid deterioration of furnace crowns, and irregular firing owing to furnaces near fans getting more air than those further away. These defects,

especially the second one, can never find a place in any system destined to replace our present methods with advantage and the much desired economy.

Yours truly,
SIDNEY H. WELLS,
Wh. Sc. Stud. Inst. C.E.

ENGINEERING DEPARTMENT,
DULWICH COLLEGE,
October 22nd, 1887.

STEAM DIRECT TO AUSTRALIA.

To the Editor of THE MARINE ENGINEER.

SIR,—In answer to your correspondent in this month's number regarding the question of any steamship having made the passage to Australia without coaling at any port after leaving England, I send the following taken from an Australian paper on the arrival of s.s. *St. Osyth* :—

"Again we have to record the arrival of this steamer after the quickest passage on record, she having eclipsed on this occasion her previous unprecedented run. This time it has been done under steam all the way and direct, no ports having been called at. Taking the passage throughout it was very unfavourable as far as weather was concerned. The consumption of coal was 1,450 tons, at the rate of 33 tons per day. The passage of the *St. Osyth* from her anchorage at Plymouth to the anchorage in Hobson's Bay has been performed in 42 days 23 hours. Left Plymouth November 18th, 1875, the latitude of the Cape of Good Hope reached 11th December, and Hobson's Bay on the 1st January, 1876. The *Whampoa* also went out direct in the same year."

Yours, &c.,
A. W. K.

September 26th, 1887.

ENGINE DRIVERS OF STEAM PLEASURE YACHTS.

To the Editor of THE MARINE ENGINEER.

SIR,—I have been amused very much by the way two engineers of yachts have taken up a letter I published in your journal a few months since, respecting the Board of Trade allowing engine-drivers of pleasure yachts with four years' sea service to appear before them and to obtain at their hands engineer certificates of competency. I am at a loss to understand why these gentlemen should have taken the matter up, and distinctly say what I write is not true; perhaps, what I have written is only true for them or their friends. These yacht engineers inform us that they are mechanics; then I fail to see why my previous letter should concern them. The yacht engineer obtains his certificates while in the merchant service, which I maintain should only be allowed; while Mr. F. C. Hayes states that in addition to nine years in a fitting shop, he put in two years and one month in a yacht, and the Board of Trade allowed him to pass. Now, Sir, I maintain that the Board of Trade should not have allowed that gentleman to pass, for the following reasons :—The Board of Trade do not compel yachts to carry certificated officers of any grade, then why count their time? The Board cannot possibly get at a candidate's sea time correctly, it is jumped at, no record being kept by the Board of Trade of yacht movements.

As Mr. Hayes very justly remarks, respecting himself, that the examiner at Basinghall-street doubted whether in two years and one month's service in a yacht, he had put in twelve months' sea service. Sir, with such confessions, the merchant sea-going engineers will agree with me when I say our Board of Trade should not allow sea service in a pleasure yacht to count at all, it is unfair to merchant sea-going engineers. I may say that a single voyage across the western ocean against a westerly gale in a merchant ship would give an engineer more sea experience than the whole of the before-mentioned time in a pleasure yacht. I beg to state that I am extremely obliged to Mr. Hayes for his attempt to enlighten me on the letter written by the Yacht Engineer, but I happen to understand the English language fairly well; what a person writes and what they mean is vastly different.

To quote your correspondent, Yacht Engineer's words, perhaps the following will come as a surprise to him:—The Yacht Engineer says anyone does not go engineer of a yacht. I beg to deny that statement, as only three months ago the steam yacht *Gladys*, owned by Mrs. Stewart, sailed from Dartmouth Harbour with a shipwright as chief driver. Your yachting correspondents will doubtless know this yacht. I should think she is 50 H.P. I could quote other cases if I chose.

The Yacht Engineer says he shall be happy to assist in any petition. All I can say is for him to write to the Honorary Secretary, Marine Engineer's Union, 91, Minories, Tower Hill, London, E., and ask to be allowed to join the New Union, for that is the quarter you will find all our petitions to the Board of Trade come from, and in a very proper manner, which I trust the Board of Trade will carefully consider the justice of and accept.

Thanking you again, Mr. Editor, for your kindness,

Yours truly,
W. F. O.

Miscellaneous.

THE new twin-screw armour-plated cruiser *Warspite*, a sister ship to the *Impérieuse*, has been completed for sea.

A NEW system of constructing torpedo boats has recently been patented by Mr. J. Y. Short, of the firm of Short Brothers, Pallion, Sunderland. The plan consists in building the vessel in the ordinary way, so far as the external plating and transverse bulkheads are concerned, but these latter are connected together by a series of water-tight longitudinal bulkheads, fitted some distance away from the outer skin, and this space it is intended to fill with cork or some similar material.

TURKISH SUBMARINE BOATS.—Some Turkish submarine boats built on the Nordenfelt plan have been undergoing trials at Constantinople. They are of the following dimensions :—Length, 100 ft.; beam, 12 ft.; displacement, 160 tons. The engines are of the ordinary surface-condensing compound type with two cylinders, and are of 250 I.H.P. The circulating and air-pumps are worked by a separate cylinder. The main engine is thus left free to work or not, while a vacuum is always maintained to assist the various other engines with which the boats are fitted.

PROFESSOR BARR ON THE TRIPLE-EXPANSION MARINE ENGINE. —On October 12th, Professor Barr gave the first of his course of lectures on Modern Steam Boilers and Engines to his evening class in the Yorkshire College, Leeds. Mr. A. H. Meysey-Thompson presided, and the lecture-room was crowded, all the available standing room being occupied. The first prize in the Applied Mechanics class was awarded to Mr. Ernest Scott, and in the Steam Engine class to Mr. F. G. Heseldin. A number of certificates were also distributed to the students next in order of merit. Professor Barr said that in beginning a course of lectures on modern steam boilers and engines, it would not be out of place to ask whether there was any clearly indicated tendency of the age in regard to engine design. The tendency of the age was to work at higher and higher pressure. In 1840 marine engines were built to work with steam at 4 lbs. pressure above the atmosphere, and it took thirty-five years to raise the commonly adopted pressure to 60 lbs. per square inch. It had only, however, taken the last ten years or so to make the 60 lbs. 160 lbs. in marine practice. Surely, then, there was there a clear indication of the tendency of the age in engine design. To utilize this higher pressure, important modifications had been introduced from time to time in the process by which the work was obtained from the steam, the latest of these being seen in the triple-expansion or quadruple-expansion engine of to-day. The marine engine of to-day was the highest type of prime mover yet constructed, and must therefore be of great interest to all who were engaged in engineering work of any kind. Without attempting to forestall the future historian of the rise and progress of the marine engine, the lecturer said he might be permitted to mention the names of three men who, whatever positions might be accorded to them by posterity in connection with their subject, might be taken as typifying the three classes of workers who had brought the steam engine to its present position. The first of these was Carnot, whose theory of heat engines was published in 1824. The work of Mr. Samson Fox, in introducing the corrugated flue, must also be recognized, for without that invention the rapid progress which has been made in marine engineering in the use of higher pressures would not have taken place. As typical of the scientific engineer, they had Mr. Alexander C. Kirk, of Glasgow, who first brought the triple-expansion engine into successful practice. The theory of the triple-expansion engine was described, and examples were given to show the very great economy resulting from its adoption. The lecturer said he had received a letter from Messrs. Duncan Stewart & Co., of Glasgow, in which they stated that in a trial made a few weeks ago of the first triple-expansion engines which they had built, they obtained the very remarkable result of a consumption of only 1·05 lb. of coal per I.H.P. per hour.

The new lighthouse at Tory Island, which was lighted for the first time on October 1st, is provided with Wigham gas burners of exceptional power. These are arranged so that gas may be economized in fine weather by lighting only 32 jets of one burner, but on the occurrence of fog the remaining jets, 76 in number, are lighted, and two more burners, each containing 108 jets, are brought into operation, greatly extending the range of the light. Gas-making plant is provided on the island, and is adapted to utilize either cannel coal or crude oil, should the use of the latter be at any time deemed advisable. A powerful fog siren completes the equipment of the lighthouse.

A vessel of rather peculiar construction has just been completed by Messrs. Raylton, Dixon & Co., at Middlesbrough, and has, we understand, been purchased by the Italian Government. This steamer is intended for carrying large guns and heavy machinery. She has a clear hatchway of 75 ft. in length; a cellular bottom of extra strength, besides being stiffened throughout with web frames, and every compensation for this unusually large opening, which is, we believe, much the largest hatchway with which any steamer has been constructed. Her masts and gear are all of great strength, her derricks being of steel, and she has, in addition, a set of tripod shear legs, arranged to be erected on sockets over any part of the hatchway, and capable of lifting about 50 tons. The dimensions of the vessel are:—195 ft. extreme length, 28 ft. beam, and 12 ft. 6 in. depth of hold to top of tank. The engines have been constructed by Mr. George Clark, of Sunderland, and are on the triple-expansion principle.

Obituary.

THE *Manchester Guardian* announces the death at the age of 48 of Mr. Charles Moseley, which took place on October 1st at Manchester. Manchester has given birth to few more remarkable men than Mr. Moseley. Until a few years past he was comparatively little known beyond a limited circle of friends who had learnt to appreciate his ability and extraordinary force of character. From early boyhood he was associated with the business which it has been the task of his life to build up. The firm of D. Moseley & Sons has now almost a world-wide reputation. It employs nearly a thousand hands, and has fostered an industry which is all the more remarkable as being entirely unassociated with the staple trade of the district. Mr. Charles Moseley was for many years little known to the general public. It was not until some eight or nine years ago that his interest in the telephone induced him to step forward into public life. He at one time contemplated establishing a private telephonic exchange in Manchester, but after the amalgamation of the Edison and Bell companies he was induced to accept overtures from the Lancashire and Cheshire Company which resulted in his appointment as their chairman. In nothing was his energy more displayed than in a contest with the Post Office, who strove, under the Telegraphs Act, to prevent the establishment of telephonic communication between adjoining towns. Mr. Moseley put himself in correspondence with the various Parliamentary representatives of the district, and so convincing were his arguments that from time to time questions were asked in the House which Mr. Fawcett had great difficulty in answering. Subsequently Mr. Moseley had frequent interviews with the Postmaster-General, and it is not too much to say that he succeeded in converting him almost entirely to his views. As a result the present "trunk line" system has been developed, by which it is possible for most of the Lancashire towns to hold telephonic communication with each other. Since that time Mr. Charles Moseley has been one of the most noticeable persons connected with Manchester life. When the Edison Electric Light Company was formed his interest in electricity induced him to take a leading position as a director. But it is only within the last 18 months that Mr. Moseley's name has become a household word among Lancashire people. When the fortunes of the Manchester Ship Canal seemed at their lowest he was one of those who consented to form a consultative committee to consider and report upon the merits of the scheme; and when he and several other gentlemen reported in favour of the scheme the faith of the public in the venture was practically established. Like some others of the consultative committee, he entered on the inquiry, if not in a hostile spirit, at any rate in a spirit of incredulity as to the possible success of the undertaking. And, as is now generally known, he and his colleagues on the committee were absolutely converted by the evidence which was laid before them. "I fully believe," Mr. Moseley said to a friend, "that the canal will pay 5 per cent. on its capital within two years of its being opened. I should not be surprised if it should pay 10 per cent., though, of course, that is a statement which I dare not make to the public." The capital is now subscribed, and there is, therefore, no longer a reason why the opinion of one of the most clear-sighted of the citizens of Manchester should not be stated. He subsequently took a leading part in arranging for the Manchester Jubilee Exhibition. Mr. Moseley was ever ready to give council and aid where these were deserved. A hard worker himself, he had no sympathy with idleness in any form. But struggling worth or undeserved misfortune never appealed to him in vain. Hardly a day passed in which he was not asked to assist in the development of some new invention or to forward some fresh scheme of commercial enterprise, and he was the life and soul of other enterprises than the Chapelfield Works with which his name is principally associated.

Reviews.

Reed's Engineers' Handbook. By W. H. Thorn, Sunderland: Thomas Reed & Co.

PROBABLY the best testimony that we can offer as to the value of this ever increasingly popular handbook is to simply record the fact that the twelfth edition of it is now before us; for when we see so many editions of a technical work called for, we may assert, without fear of contradiction, that it contains many inherently good qualifications, else the demand for it would not have been so great. While possessing all the good qualifications of the previous editions the present one has the great advantage of being brought down to date, an advantage which cannot be over estimated when the rapid strides that are daily being made in every department of marine engineering are borne in mind. Another very important feature of the present edition is the increased number of illustrations of parts of the machinery and other objects referred to in the text, amounting in all to two hundred and ninety-seven, as well as the larger plates of indicator diagrams and of parts of engines, numbering thirty-six, and (it is believed by the author) comprising an example of every subject that has ever been given at the drawing part of the examination, and which taken altogether leave scarcely any part (and certainly none of importance) undelineated. All new questions and the latest requirements for the Board of Trade examinations have also been added, and the book in its present form is *par excellence* the Marine Engineer's *vade mecum*. In no book do we remember to have seen that very ordinary looking, but sometimes puzzling, affair, an indicator diagram, better handled; indeed the author deals with it in such a lucid and comprehensive manner as to render the book valuable if only for the information given on this one subject alone. Finally, we can only say that Mr. Thorn has managed to pack between the covers of his book more solid information than exists in any other work of the kind with which we are acquainted, while his reputation as a mechanical draughtsman is well maintained by the excellent set of drawings with which he has embellished the book.

Thorn's System of Tuition by Correspondence.

WE have recently received from Mr. W. H. Thorn, of 5, Waterville Terrace, North Shields, a sample set of papers, together with a syllabus of the system that he has organised for the use of engineers preparing for examination, who are unable, from the fact of being at sea, to attend the usual classes. Mr. Thorn has prepared altogether some 17 papers for first-class, 16 for second-class, and 13 or 14 for Board of Trade surveyors and extra first-class, these numbers not including the elementary sheets, drawings, instruction in indicator cards, written answers to the viva voce portion of the exam., &c. Taken altogether, Mr. Thorn appears to have prepared a most useful and comprehensive set of papers for each grade, and in reading through them one cannot fail to be struck with the enormous strides that have been made in recent years in the education of a marine engineer. With such a set of papers before him, and backed up by the excellent system Mr. Thorn has elaborated for tuition by correspondence, we think that any engineer who fails to pass his examination, may thank himself for his failure, and not his tutor. To those of our readers who permanently reside abroad, it may be interesting to know that Mr. Thorn will undertake to prepare them, by correspondence, for any of the Colonial examinations.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from September 20th to October 17th, 1887.

12338 W. Fordyce. Anti-fouling composition for ships.
12357 R. M. Bryant. Anti-incrustation preparation for boilers.
12371 G. A. Calvert. Screw propellers.
12394 S. A. Johnson. Steam vessels.
12450 S. Moss. Ships' globe lamps.
12479 Sir E. J. Reed. Armoured ships.
12514 F. R. Francis. Telegraph apparatus for ships.
12535 C. T. Dennis & A. R. King. Stretchers or foot boards for rowing boats.
12537 Redfern (F. Schnitzlein). Steam boiler water gauge.
12544 W. Allan. Multiple expansion or compound engines.
12545 W. Allan. Marine engine slide valves.
12556 A. MacLaine. Heating and regulating the supply of feed water for steam boilers.
12598 H. W. Pendred. Operating steam engine valves.
12601 T. Leportier. Ascertaining true position of vessels at sea.
12639 J. G. H. Hill & J. White. Boats.
12677 Stevenson (C. Anderson). Lubricators.
12682 G. Thorne. Reversible life raft.
12699 A. D. Marshall. Metallic packing for piston rods, &c.
12743 B. Burton. Gun ammunition.
12758 R. McDowell. Automatic sight-feed lubricator.
12804 J. Parsons. Preventing incrustation in steam boilers.
12810 J. Carter. New war ship.
12812 L. Rouviere. Injectors.
12813 J. D. Hickman. Rudder attachment.
12814 J. D. Hickman. Rudder attachment.
12816 J. Brown & J. Hedger. Boats' rowlocks.
12845 S. Maj. Valdivielso. Life-saving jacket.
12867 G. Sparrow & W. S. Kelly. A folding bath for use at the side of a ship.
12898 F. J. Britten. Marine chronometers.
12922 C. L. Hunter. Loading ships.
12932 G. Fowler. Life raft or boat.
13009 W. Absalom. Launching and raising ships' boats.
13014 E. A. Hayes. Distributing oil on water.
13021 T. V. Trew. Steering ships.
13030 G. Stuart. Firing mechanism for guns.
13052 P. Armington. Steam engine piston valves.
13082 W. J. Steves & A. J. Hill. Screw propellers.
13094 J. T. Short. Torpedo vessels.
13125 C. L. Wells. Obtaining fresh water from sea water.
13147 J. O'Kelly & B. A. Collins. Torpedoes.
13153 C. F. Hengst. Repeating ordnance.
13171 J. C. Kenworthy. Hoisting and lowering ships boats.
13175 H. Aspinall. Governor for marine engines.
13185 A. Harrison. Steam dredgers,
13269 H. Davey. Value gear for pumping engines.
13270 H. Davey. Pumping engines.
13271 T. G. Stevens. Ships' rudders.
13292 J. L. Grandison. Lubricators.
13312 J. A. Radley. Dredging apparatus.
13315 B. Dickinson. Screw propellers.
13359 P. Buckley. Union joint and check valve.
13422 G. Dawkins. Supporting ships' boats.
13431 Thompson (W. B. Wright & E. T. Williams). Furnaces burning hydro-carbon.
13432 J. G. Fisher. Lubricator.
13442 W. H. Wilson & W. J. Pirrie. Ships' cabins.
13469 J. Bowden. Repeater gun for torpedo boats, &c.
13493 J. M. Emerson. Steam life boats.
13495 H. D. Nance. Stopping holes in vessels.
13552 C. F. Archer. Flexible coupling for propeller shafts.
13580 W. Welch. Ships' propellers.
13681 R. Armstrong & E. J. Caiger. Protecting marine propeller shafts.
13696 C. Tasfield. Paddle wheels.
13697 A. H. Brown. Feathering paddle wheel.
13701 W. Brewster & G. H. Tulloh. Ship's indicator to show direction of travel.
13733 J. Wilson. Warping or mooring ships.
13770 H. F. Hiron. Anchors.
13853 S. A. Calvert. Transmitting orders on steamships, &c.
13876 G. F. Simms. Anchors.
13878 A. T. Dewar. Ships' boats.
13897 G. Rollo. Converting certain marine engines into triple expansion engines.
13909 F. W. Dunaway. Screw propellers.
13937 T. Bowden. Ship raising apparatus.
13981 J. Ubsdell-Thorns. Watertight armour plate.
13986 Bromhead (J. C. Witmer & J. R. Breueggemann). Double action rudder and brake for vessels.
13992 T. Leith. Screw propellers.
14002 V. St. L. S. Kelly. Propelling vessels at sea.
14061 J. Johnson. Saving persons from drowning.
14086 W. H. Eastwood. Engine packing.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

September 24th, 1887.

Barclay, James.. E1C Gr'nock

October 15th, 1887.

Napier, Richd. J. E1C Leith

September 24th, 1887.

Allan, William..	2C	Glasgow
Auld, James	1C	,,
Bartlett, Geo. H.	1C	Cardiff
Brand, Andrew L.	1C	Aberdeen
Brown, George..	1C	Glasgow
Cook, Albert E.	1C	Cardiff
Coulson, Cuthbert	1C	W.H'pool
Coverdale, Ed. ..	2C	,,
David, George W.	2C	Hull
Davies, John....	2C	Cardiff
Dickinson, Wm.	2C	Liverpool
Ferguson, Robt.	2C	Glasgow
Frazer, Geo. H.	1C	Cardiff
Geddes, John B.	1C	Liverpool
Gray, Robert ..	2C	Glasgow
Hampton, Wm..	1C	Aberdeen
Hipwood, Ed. T.	1C	Cardiff
James, Edwin C.	2C	,,
Jones, Edmund..	1C	,,
Killenden, James	1C	Liverpool
Milton, James ..	1C	,,
Muirhead, James	2C	Glasgow
Murdock, James	2C	,,
Murray, John ..	1C	W.H'pool
Nisted, V.......	1C	,,
O'Brien, W.	2C	Cardiff
Paterson, A.	2C	Glasgow
Pounder, Robt...	2C	W.H'pool
Rickard, H. J. ..	2C	Cardiff
Robson, John B.	2C	Dundee
Ross, George....	2C	Glasgow
Samuel, Wm. E.	2C	Cardiff
Sutherland, J. S.	1C	Liverpool
Wake, Tom	1C	W.H'pool
Whyte, Wm. ..	1C	Dundee
Williams, G. A.	2C	Cardiff
Wilson, John ..	2C	Liverpool

October 1st, 1887.

Baxter, Chas. ..	1C	London
Corin, Philip B.	1C	Sunderl'd
Dixon, Fred	2C	Sunderl'd
Douglass, Samuel	2C	N.Shields
Goode, Jos. W...	1C	London
Henderson, Wm.	1C	Sunderl'd
Marshall, W. R.	1C	N.Shields
Morison, Donald	2C	London
Newton, Robert	2C	L'pool
Price, Wm. F. ..	2C	Southpt'n
Rogers, Wm. ..	2C	N.Shields
Scott, Frederick G.	1C	,,
Skipworth, G. P.	1C	London
Slight, Robt. M.	2C	,,
Thickell, R. H. W.	2C	Sunderl'd
Todd, John C. ..	2C	London
Tomlinson, P. S.	2C	Liverpool
Widdowson, J. D.	2C	London
Wilkins, D. W.	2C	Southpt'n

October 8th, 1887.

Alsbury, James	1C	Leith
Augus, John....	1C	Glasgow
Barr, Matthew..	1C	,,
Barwick, Herbert	2C	London
Calder, Alex.....	1C	Leith
Carr, Ernest E...	2C	London
Crawford, J. D.	2C	Liverpool
Fergusson, J. Mc.	2C	Glasgow
Gledden, Tom W.	2C	N.Shields
Hopcroft, E. D.	2C	Liverpool
Isaac, Frederick	1C	Glasgow
Kemp, John	2C	,,
Levens, Robt. J.	1C	Belfast
Magee, Fredk. ..	1C	,,
LcLaren, John..	1C	Leith
McLean, John ..	2C	,,
Minto, John J. ..	1C	,,
Mitchell, Charles	2C	Glasgow
Morgan, Wm. ..	2C	Liverpool
Munn, Richard..	2C	London
Nichols, Fredk...	1C	,,
Roberts, Harry..	2C	,,
Rough, A. J. ..	1C	Liverpool
Smith, James ..	2C	London
Sharples, A. E.	1C	Liverpool
Todd, Isaac	2C	Belfast
Treasurer, A. W.	2C	Leith
Turner, Douglas	1C	Glasgow
Wilson, David ..	2C	Leith
Yeoward, W. R.	1C	Liverpool

October 15th, 1887.

Aird, Hugh	1C	Dublin
Barclay, Alex. ..	2C	Greenock
Corner, Alfred ..	1C	N.Shields
Dixon, Wm. J...	2C	,,
Dunn, John	2C	Greenock
Freese, Rob. G...	2C	London
Fowler, John S..	2C	,,
Houston, John J.	2C	Liverpool
Jackson, Thos. W.	2C	Hull
Johnston, Geo. B.	1C	Greenock
Kyle, N. M. W.	2C	N.Shields
McDearmid, D...	2C	,,
Rayner, F. W. ..	2C	Liverpool
Refarel, Chas. F.	2C	N.Shields
Rowley, John ..	2C	Greenock
Rushton, John ..	2C	N.Shields
Spiers, Robt.....	1C	Greenock
Stewart, James..	1C	,,
Taylor, Geo.	2C	London
Thompson, Jas...	2C	,,
Walker, John ..	1C	N.Shields

The Marine Engineer.

LONDON, DECEMBER 1, 1887.

EDITORIAL NOTES.

LAST month occurred one of the most disastrous collisions that has happened for some years. The screw steamer *W. A. Scholten*, of about 4,000 tons burden, of the Red Star Line, sailing from Rotterdam for New York, sank in the channel by collision with another steamship supposed to be of Hartlepool. No less than from 130 to 140 of the crew and passengers have, it is believed, been lost with the vessel. There is little doubt that the percentage of collisions is constantly increasing, and will continue to increase in proportion as the frequented waterways get more and more crowded with vessels. It is difficult to understand how two vessels, having all the channel for their seaway, can come into collision at all, and we believe that it is due to the obstinate adhesion of the captains in persisting in steering a direct course, whether other vessels may be crossing that course within a dangerous proximity or not. We can understand that it may give some trouble to a master as to his dead reckoning were he constantly to divert from his course for fancied obstacles, and we can also understand that a seaman at the wheel must not lightly vary his course except by express direction. Yet we think that were the regulations more explicit as to the distances at which vessels should pass one another when at sea, or were captains of their own accord to adopt such rules, and see that they were carried out by their mates, a sufficiently wide berth should be always given to other vessels or steamers that might be met, and we should soon see a considerable decrease in the large number of collisions now constantly occurring. It is noticeable by any passenger at sea that where the courses of two steamers, or of a steamer and sailing vessel intersect, the steamer thinks nothing of passing the sailing vessel or the other steamer within a short distance of 40 or 50 yards. Although such passages may be made without disaster hundreds of times, it is overlooked that any slight miscalculation of relative speed on the part of either or both vessels, or clumsy steering, may at once bring about unforeseen disaster. Where, in addition to these risks attending close passage of other vessels, there is also a fog which may deceive the look-out on either side as to the relative speed of the vessels or their direction, the chances of disaster are enormously increased. This was the case in the said disaster to which we are referring, where a heavy fog which had hung about our coasts for many days had so obscured the channel, that the *Scholten* had been actually at anchor, and upon approaching another steamer in the channel, it was thought by the officers of the *Scholten* that the former was at anchor, and they accordingly steered to pass her with what was considered sufficient sea room. When nearing her it was discovered that the other vessel was going ahead, though she is stated not to have had up side lights, and the collision ensued before the course could be altered. It is possible that the Hartlepool vessel had also been at anchor, and had but just got under weigh, but there was evidently no margin allowed by either vessel for a suitable distance of separation whilst passing to allow for any error of observation, of course, or speed. It would be well if any of our ingenious readers can devise either such a warning or such a protective apparatus as would in any way automatically tend to prevent collision. We have heard many suggestions of apparatus for these purposes, but in no case of an apparatus which might be termed of practicable value.

MR BRUCE, in his address to the Institution of Civil Engineers, gives some interesting details as regards the building, proportions, and engines of vessels in modern times as compared with fifty years ago. Some of these statistics with regard to the rapid increase of the tonnage of iron vessels as compared with wooden vessels, and steamships as compared with sailing vessels, are already well known to our readers from our pages. The rise in average tonnage has been latterly very marked, and the necessary increase of dimensions must have materially affected the mechanical arrangements of the shipyards necessary to construct the enormous liners of the present day. No doubt the introduction of iron, by providing a material in which any required length could be employed without loss of strength in the parts, has greatly facilitated the modern increase of dimensions, which would have been impossible where timber alone had to be relied upon. It is supposed that the use of timber in building ships reached a limit of length at about 300 ft., and it is only the introduction of iron and steel that enables the greater lengths of 500 and 550 ft. to be employed. Paddle steamers were first employed in 1837, and driven by side lever engines with boilers of the old flue type at a working pressure not exceeding 6 or 7 lbs. Afterwards larger dimensions were employed in the engines, and the pressure gradually raised to 20 lbs. per square in., consuming about 4 lbs. of coal per I.H.P. per hour. The introduction of the screw propeller necessitated an entire change in the design of the engines for driving them. This gave rise to a system of direct action engines which, when aided by the adaptation of the surface condenser

and increasing water pressures, reduced the consumption of coal to about 3 lbs. per I.H.P. per hour. The Woolf double cylinder engine was the first attempt of compounding of the high and low pressure cylinders, which produced undoubted economy, but was not generally regarded with favour. Later the general compounding of engines was introduced with initial pressures of 50 to 60 lbs. per square inch, upon which the consumption of coal fell to about 2½ to 2¼ lbs. per I.H.P. per hour. Since then the introduction of mild steel has been possible to increase the working boiler pressure up to 90 or 100 lbs. per square inch, which has effected a diminution of consumption to slightly under 2 lbs. of coal per I.H.P. per hour. With the latest improved triple-expansion cylinders and 160 lbs. initial pressure, representing the latest improved types now in existence, an economy of consumption not exceeding 1½ lb. per I.H.P. per hour has been effected. It may be thus roughly estimated that, as compared with the consumption of fuel fifty years ago, the present consumption of fuel is not more at the present time with latest improvements than about a quarter of the fuel then required. Increase also of speed, by the improved character of propellers and greater length of vessels as compared with their beam, has been also very marked in the last half century, and Mr. Bruce goes so far as to prophesy that we may consider such progress, having been steady and gradual, is likely still to continue with more noteworthy results. Much talk is often made at the present day as to the excellent rates of freight which formerly were obtained and the comparatively meagre rates now obtainable; but if the reduced costs of steamship transit is now compared with that of former days, a great deal of the present reduction of rates is fairly explained by reduced expenditure.

THE Manchester Ship Canal has at last been commenced, but in a strangely modest and quiet manner having regard to the magnitude and importance of the work in question. One would have imagined that for the work of such national importance royalty might have been found sufficiently disengaged to render some *éclat* to the proceedings, or that at least a gathering of prominent political and other personages might have been brought together for the occasion. As it was, the directors carried out the whole inauguration in the most ordinary and business-like manner. With an ordinary navvy's spade, the chairman, Lord Egerton, cut the first sod, the other directors following suit, and immediately adjourned to the business-like proceeding of examining the plant for commencing the enormous undertaking, which had been collected at the spot by Mr. Walker, the well-known contractor. This cool, business-like method of procedure is, however, somewhat characteristic of the hard-headed northerners who are the prominent leaders and directors of this enterprise, and if the whole of their work is conducted in the same business-like way, the shareholders will have little cause to grumble. A plant of some fifteen locomotives, enormous steam navvies or excavators, massive cranes, and a large quantity of steel rails have been accumulated on this spot. It is expected now that rapid progress will be made and the works are already in active progress, the excavators having been put in position and the railways laid out. Only one section has been put in hand at the moment, which, it is estimated will employ about 2,000 men. When the whole work is in progress it is estimated that it will employ between 20,000 and 30,000 hands. This should be a great boon to the unemployed.

APROPOS of the Manchester Ship Canal, there is a good deal of anxiety and agitation as to the bar of the Mersey. Seeing the enormous traffic which is now constantly passing from the Mersey between England and America, the largest tonnage of goods being shipped from Liverpool of any port in the Kingdom, it is somewhat humiliating that it should be possible that such a traffic should be so materially interfered with by a bar of sand that steamers travelling 3,000 miles of ocean in little more than a week may be delayed four or five hours in the open sea before they can reach a safe anchorage. It is not as if such an obstruction was a navigable one; it is but composed of sand, and could doubtless be dealt with without difficulty by the powerful engineering appliances of the present day. It seems to be a mere matter of money. Mr. Shelford, at the meeting of the British Association, gives a great number of useful particulars. It appears that this bar is variable in its position and height. Its depth at low water spring-tides has varied from seven to seventeen feet, and the main channel has been constantly shifting. Perhaps it is in the interest of pilots that this bar has been so long a hindrance and an obstruction to the traffic of the port. The sand banks do not appear to have moved seawards for the last century, so that it would appear feasible to so direct the enormous volume of tidal force to obtain a better depth in at least one channel for navigation. This seems reasonable from the fact that a depth of seventeen feet has existed formerly for some time. There is no doubt that it is a want of concentration in the ebbing tide, which is now distributed over many channels, that has allowed so large an accumulation of sand. We are

of Mr. Shelford's opinion that dredging is merely postponing an evil where the silting up of a channel has to be dealt with. Should the city of Liverpool think it worth their while to free their port from such an obstruction, the work once done should be self-maintaining. Professor Reynolds has constructed a most interesting model, provided with water tanks at either end, and an intermediate sandy channel representing the bed of the Mersey, and by the oscillation of the model producing alternate flow and ebb; it is extremely interesting to find that almost identical conditions to that of the bed of the Mersey are reproduced in the model. The accumulation of sand seems to be largely due to the powerful south-western on-shore gales, and this leaves an accumulation which the ebbing and flowing tide merely oscillates backwards and forwards. After in-shore gales the bar increases in size, and after an absence of such gales with heavy tides the variable depth over it is somewhat increased. We do not despair soon of seeing this obstruction to business taken up by the Liverpudlian authorities, and cleared out in an energetic and thorough manner.

PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.*

By FRANK C. MARSHALL, Esq., Member of Council.

IN 1881 I had the honour to read a paper before the Institute of Mechanical Engineers in this city upon the "Progress and Development of the Marine Engine," and it has been suggested to me that the meeting of this Institution, in the same locality and city, presents an appropriate opportunity of putting on record the present position of marine engineering, and of drawing attention to the really important progress made in this profession since that date.

Some parts of the subject have already been fully dealt with in the excellent papers read by Mr. W. Parker, at the Liverpool meeting of the Institution last year; by the late Mr. Wylie, at the Institute of Mechanical Engineers at Leeds; by Mr. Percy Hall, at the North-East Coast Institution of Engineers and Shipbuilders; and in the paper which, together with Mr. R. L. Weighton, I read from this place recently on "High-Speed Engines."

In my former paper I gave particulars of the principal proportions and performances of 39 steamships, and showed by comparison with similar data given in 1872 by Sir F. Bramwell as the average of 28 steamers, that during the nine preceding years substantial progress had been made, not only in economy of fuel, but also as regards the amount of power and speed obtained, whilst at the same time I drew attention to the necessity of paying greater attention to the weights of machinery in proportion to the power developed—a matter which in special cases is of greater importance than economy of fuel. It may be interesting here to note that in 1872 the average consumption of coal per I.H.P. per hour was 2·11 lbs., while in 1881 it was only 1·828, showing a decrease of 13·38 per cent.; the piston speed in 1872 averaged 376 ft. per minute, against 467 ft. in 1881; while the average working pressure was 52·5 lbs. in 1872, against 77·4 lbs. per square inch in 1881. In concluding I remarked as follows: "As increased pressure means increased efficiency, there does not appear any reason why the standard of 150 lbs. should not be sought as that of the future."

In the six years which have since passed very great progress has been made in all these points. As regards economy of fuel, the greatest step taken has been the introduction of the triple-expansion engine, which since the successful work done by those introduced by one of the members of our Council, Mr. A. C. Kirk, in the s.s. *Aberdeen*, which commenced running in 1882, has come to be practically universally adopted for all new merchant steamers, as well as for all new war vessels, and 150 lbs. has also now become the normal working steam pressure.

In Mr. Hall's paper, already alluded to, the results are given of several voyages made with cargo steamers, running at moderate speeds, with an average consumption of 1·512 lbs. of coal per I.H.P. per hour with triple-expansion engines, against 1·955 lbs. with ordinary two-cylinder compound engines in vessels engaged in similar trades, showing a reduction of 22·6 per cent. These figures speak for themselves, and I think we may reasonably expect that a careful and patient attention to details and proportions of the present type of engines and boilers will result in at least some additional economy, in the same way that small improvements in design led to the progress which my previous papers recorded as having been achieved in the now old type of double compound engines between 1872 and 1881.

The recent developments, as regards power of engines and speed of vessels, are really remarkable. In 1881 the merchant steamer of largest power then at work was the *Arizona*, having cylinders of 62, 90, and 90, with a stroke of 66 in. She was then considered to be quite an exceptional vessel, but she has since been followed by the following vessels of greater power, the particulars of which were given in the valuable paper read at Liverpool last year by Mr. John, and some of which I have ventured to restate in the following table:—

Vessel.	Diameter of Cylinders.	Stroke.	I.H.P.
Alaska	68, 100, 100	72	10,000
America	63, 91, 91	66	7,354
Aurania	68, 91, 91	72	8,500
City of Rome ...	43, 43, 43, 86, 86, 86	72	11,890
Etruria	71, 105, 105	72	14,321
Oregon	70, 104, 104	72	13,300
Servia	72, 100, 100	78	10,300
Umbria	71, 105, 105	72	14,321

Previous to the *Arizona* the greatest power developed in any of the Atlantic liners was about 5,000 I.H.P. on a piston speed of 600 ft. per minute; now we have the *Etruria* and *Umbria*, each indicating regularly a power of over 14,000 horses, on a piston speed of over 900 ft. per minute.

The intercommunication between our own country and the Continent, as well as that between the islands constituting our United Kingdom, has, within the period under consideration, received great impetus by the placing in the several lines steamers of enormous power, notably the *Victoria* and the *Empress* recently placed on the Dover and Calais route, and the *Queen Victoria* and *Prince of Wales* between Liverpool and the Isle of Man, vessels driven at the unprecedented speed of from 20 to 23 knots by a steam power of from 6,000 to 7,000 horses.

The results in point of speed are also remarkable. From the figures given by Mr. John in the paper referred to, it appears that the time of crossing the Atlantic has been reduced from 8¼ days to 6¼ days. It is remarkable that none of these celebrated Atlantic mail steamers have been fitted with triple-expansion engines. Several vessels of equal power have, however, been recently built, and there are now in process of building two large vessels, having triple-expansion engines and boilers worked with forced draught, said to be intended to develop 18,000 H.P., the performances of which are expected to eclipse those of all the vessels which have preceded them. I need hardly say that the whole of the engineering world will be greatly interested in these vessels.

Turning our attention from the Mercantile Marine to war vessels we see quite as great improvements. In 1881 the fastest cruisers afloat were H.M.S. *Iris* and *Mercury*, with a speed of 18½ knots obtained with an indicated power of about 7,500 horses. Now there are several vessels having a speed of 19 knots, and one, the *Dogali*, completed early in 1886, belonging to the Italian Navy, has attained a speed of 19·75 knots, and is at the present time the fastest cruiser afloat. This supremacy she is not likely to retain long, as vessels are now being built which are confidently expected to attain a speed of 21 knots, but she will always retain some interest as the first war vessel of large power fitted with triple-expansion engines.

The advantages of triple-expansion engines as compared with compound engines, and also the elasticity of power produced by artificial draught, are admirably illustrated by the performance

* *Read at the Twenty-ninth Session of the Institution of Naval Architects, July 28th, 1887; the Right Hon. the Earl of Ravensworth, President, in the Chair.*

of the engines of the *Dogali* above-mentioned, of the three-cylinder expansion type, and those of the *Panther* and *Leopard* belonging to the Austrian Government. The last-named vessels are fitted with two-cylinder compound engines, and their boilers are exact duplicates of those of the *Dogali*, except that they were worked at 135 lbs. per square inch instead of 150 lbs. The maximum power they developed was 6,984 horses under forced draught and 4,600 horses under natural draught, whilst the *Dogali* developed 8,045 and 5,347 respectively, an increase of about 16 per cent., due to the higher pressure and to the adoption of triple-expansion, and in each case an increase of over 50 per cent. in the power obtained by forced draught over that obtained by natural draught.

The greatest power put into one vessel previous to 1881 was, I believe, about 8,000 in the cases of the *Dandolo*, *Duilio*, *Inflexible*, and *Admiral Duperré*. In 1881 and 1882 the *Italia* and *Lepanto* were being constructed, having a power of 18,000, an enormous advance being thus made at one step. So far, our own Admiralty have not considered it wise to adopt powers of such magnitude, being content with 11,500 and 12,000 in our largest vessels. The Italian Government have now, however, in course of construction the *Re Umberto* and *Sicilia*, each with a power of 19,500 horses, and the *Sardegna*, with a power of 22,800. The *Sicilia* and *Re Umberto* are twin-screw armour-clad vessels, and their engines are of the two-cylinder expansion compound type—two sets of engines to each propeller shaft—the cylinders of which are 47 in. and 89 in. diameter respectively, with a stroke of 51 in. In the case of the *Sardegna*, the engines of which are being built by the Hawthorn-Guppy Company, of Naples, from designs by the writer's firm, they consist of two sets of triple-expansion engines for each screw, having cylinders 39, 59, and 88 in. diameter respectively, and 51 in. stroke. These engines are so designed that the forward sets in each case can readily and quickly be disconnected from the others, so that when cruising at low speeds the after engines only need be used, and thus more economical results may be obtained than would be possible with all the engines as work.*

In these engines, as in most of those of modern war vessels, the whole of the pumps are entirely independent of the main engines, and all are in duplicate, each pump being driven by its own independent engine. Each of the four sets of main engines has its own combined steam and hydraulic reversing engine, and these are so arranged that those of the engines working on one screw may be coupled together or disconnected at will in a similar way to that adopted for disconnecting the shafts, so that in case of mishap to one reversing engine the other coupled to it may be used to control either or both of the coupled sets of engines.

The boiler power consists of 18 return tube boilers, having each four furnaces. They are arranged in six separate watertight compartments—four forward and two aft of the engine rooms. The working pressure is 150 lbs.

S me idea of the magnitude of the motive power of this vessel may be formed from the fact that it consists of 62 engines, having 90 cylinders, in all representing a collective area of 47,466 square in., or a cylinder of 20 ft. 6 in. diameter. The propelling engines will be worked at a piston speed of 1,020 ft. per minute, and will constitute the largest propelling power ever introduced into any vessel, either for war or mercantile purposes.

As regards torpedo-boats and torpedo-cruisers much also has been done. The progress in the performance of torpedo-boats has been enormous. It is not, however, my intention to enter on any fuller description of these vessels, which have been—and, no doubt, will be again—so much more ably treated by other members of this Institution whose speciality they are. I would only record here the fact that the speed a few years ago of 18 to 20 knots has been increased to 24 and 26 knots, while the power has advanced from 600 to 1,400 I.H.P., principally by extended boiler power—sometimes in one boiler, in other cases two boilers and triple-expansion engines, running at 360 to 400 revolutions. The torpedo-cruiser class of vessel has been called into existence during the last six years. These vessels, in which the weight of the propelling machinery constitutes the greatest part of the total displacement, are, up to the present time, the only type of sea-going vessels in which our naval constructors have ventured to adopt the modified locomotive type of boiler. With this type of boiler, worked with an intense draught produced by fans, and with high-speed engines of specially light construction, enormous powers have been developed upon light weights of machinery.

The *Destructor*, so fully described by Mr. Biles at our last meeting, the *Lieutenant Ilgin*, of the Russian, and the *Rattlesnake* of our own navy, are the first of this type of vessel fitted with triple-expansion engines. They have each obtained a speed of between 19 and 20 knots. They were, however, preceded in point of time in the Italian navy by the *Folgore*, fitted by the writer's firm with twin-screw engines, each screw being driven by a pair of compound engines, with cylinders 19½ in. and 35 in. by 16 in. stroke, and the *Tripoli*, fitted with three screws, each driven by similar engines to those of the *Folgore*. The *Tripoli* has obtained a maximum speed of 21 knots, with 3,600 I.H.P., and the *Folgore* a speed of 22·8 knots, with 2,200 I.H.P., in either case without the engines being run at their full power, owing to the period of vibration of the vessels themselves, about 120 per minute, resulting in excessive vibration at speeds of engines of about 240 and 360 revolutions per minute, so that it was not deemed prudent to run the engines faster than 330 revolutions.

The *Tripoli* is being followed by the *Montebello* and *Monzambano*, each with three screws, but fitted with triple-expansion engines, having cylinders of 15½ in., 24 in., and 37 in. by 16 in. stroke. In these vessels the outer screws are arranged similarly to those of an ordinary twin-screw ship, while the centre screw is carried much lower than the others, the shaft emerging at the stern just above the line of the keel, and passing beneath the rudder. The blades of these screws, therefore, project below the line of keel. The general arrangement is shown in Fig. 1. In all cases each screw-shaft is made with a disconnecting arrangement, so that when cruising at less than full power either the outer twin-screws' engines or the centre engine may be worked alone, the propellers of the others being free to revolve. These engines are supplied with steam from two boilers to each engine, or six in all of the type shown in Fig. 2.

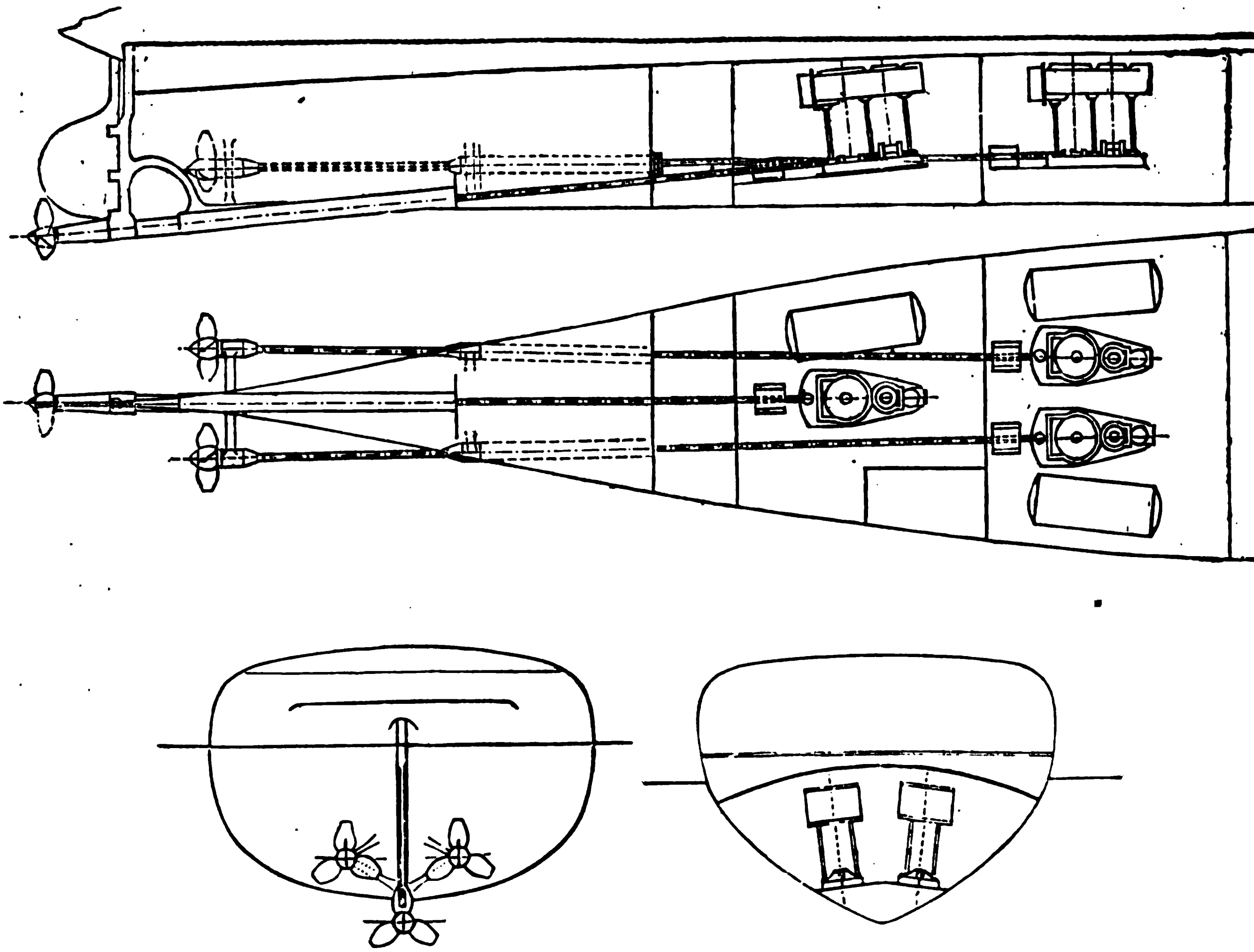
The results of some trials made with one, two, and three screws respectively, are given here, and are very interesting. They are, perhaps, not strictly comparable, as, owing to local circumstances, they were each made with somewhat different screws. The trials of one and two propellers being made with the same screws, only slightly reduced in diameter for the two-screw trial, while the three-screw trial was made with propellers of larger diameter and greater pitch; and moreover, as we have not corresponding records of the powers required to drive the vessel the same speed with all three screws, we cannot estimate precisely the propulsive efficiency of one or two screws as compared with the three screws, but it is interesting to note that the efficiency of the single screw is by no means so small as might have been supposed, considering its small size. The results are given in the following table:—

* It may be interesting to note here that a very complete working model of the port engines of this vessel may be seen in the Royal Mining, Engineering, and Industrial Exhibition now open in this city, as also the crank shaft, with its disconnecting gear. (The Exhibition is now closed).

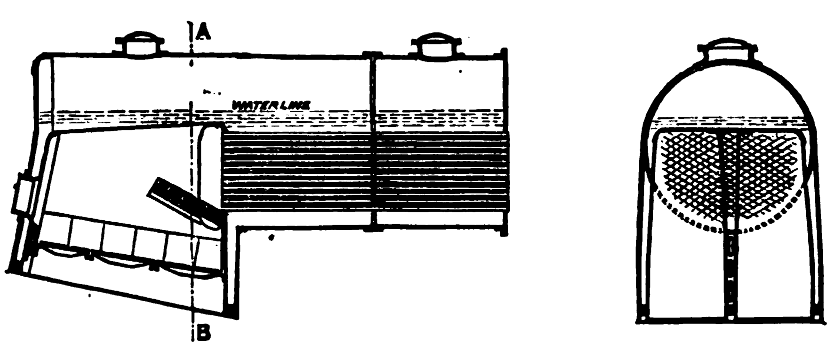
TABLE SHOWING RESULTS OF TRIALS MADE WITH ONE, TWO, AND THREE SCREWS, IN THE ROYAL ITALIAN TORPEDO CRUISER "TRIPOLI."

No. of Screws used.	Diameter of Screw.	Pitch.	Surface.	Mean Revolutions per Minute.	I.H.P. Mean.	Speed Mean.	Slip.	Mean Draught.	Displacement.
	ft. in.	ft. in.	sq. ft.				%	ft. in.	Tons.
1	5 3	6 1¼	7·15	356	1,030	14·55	·32	9 10¾	770
2	5 1	6 1¼	6·52	383	2,076	18·⅜	18·6	10 2⅝	802
3	5 9	7 1½	7·57	297	3,016	19·8	5·25	10 5½	831

Length of vessel, 230 ft.; breadth, 26 ft.



PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE. (Fig. 1.)



PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE. (Fig. 2.)

[illegible] with economy of fuel, and also with the [illegible] proportion to their power to weight [illegible] is the question of forced draught. As artificial draught is now universal with all war [illegible] becoming common in merchant steamers, it will [illegible] to notice the first application [illegible] At the outset it must be distinctly borne in mind [illegible] forced draught is now applied in different [illegible] with [illegible] opposite ends in view, and [illegible] success or the reverse depends upon the way in which it fulfils the conditions for which it was designed. In a few mercantile and in war vessels generally, especially in vessels of torpedo-boat and torpedo-cruiser type, the system has been adopted primarily, if not solely, with the view of attaining a much greater power with a given weight of boiler than could be obtained with natural draught. Boilers worked in this way, and having a limited amount of absorbing, or as it is usually called heating surface, cannot be expected to transmit so great a proportion of the heat of combustion to the water as when they are worked under ordinary conditions, consequently they are somewhat less economical of fuel in proportion to the power developed. If, therefore, the system of forced draught as applied to war vessels were to be looked at solely from the coal consumption point of view, it would no doubt be considered to be a failure, but considering the way in which it meets the requirements actually sought for, it is a great success, and has contributed more than any other single improvement towards rendering our war vessels more efficient than formerly.

The first application of this principle to marine purposes in this country was in torpedo-boats with the locomotive form of boiler. The first application to other than torpedo vessels the writer believes to have been due to Mr. G. W. Rendel, formerly of the firm of Sir W. G. Armstrong, Mitchell & Co., who in 1879 placed the contract for the machinery of three cruisers with the writer's firm, the machinery and boilers to be of the least possible weight for 2,400 H.P., suggesting at the same time the use of forced draught in the boiler furnaces. The vessels were very satisfactorily completed, two for the Chinese Government, viz., the *Yang Wei* and the *Chao Yung*, and one for the Japanese Government, the *Tsukushi*. On their trials they each gave about the same results, 2,500 H.P. under forced, and 1,912 under natural draught, with a speed of 16½ knots and 14·34 respectively.

These vessels were followed by the *Polyphemus*, in which it will be remembered boilers of the locomotive type shown in Fig. 2 were first fitted, and then in 1882 by the *Satellite* and *Conqueror*. Particulars of the very exhaustive and interesting trials of the application of forced draught to these vessels were given in Mr. Butler's paper, and recorded in the Transactions of this Institution for [illegible].

The other applications of forced draught have been adopted primarily with the idea of obtaining economy of fuel, and aim at effecting a more perfect combustion of the fuel, giving higher temperature in the furnace, and, by means of an adequate proportion of absorbing surface, less waste of heat in the chimney than is necessary to produce the natural draught. Several systems of forced draught with economy of fuel in view have been tried; that which has been the most extensively adopted is the Ferrando system, which, while equally applicable to all qualities of coal, aims chiefly at efficiently burning the small deteriorated Welsh or inferior classes of coals, and accomplishes its purpose admirably. When it is remembered that the individual particles of small or duff coal have the same composition as those of round or screened coal, it will be evident that if the duff coal can be as perfectly burned as the screened coal it will produce, weight for weight, the same amount of heat and the same evaporative effect. The economy to be obtained by using only the same quantity of low-priced small coal instead of good screened coal is of course very marked, but in addition to this, experience has shown that the more perfect combustion with this system gives an absolute saving of coal, when compared, weight for weight, with that of large coal used with natural draught.

All of the sixty-two steamers of the Florio-Rubattino Italian Line are fitted with this system, and have been working with it for a considerable period, and at the present time two of the vessels belonging to this company are being fitted by the writer's firm with new triple-expansion engines and boilers constructed specially for this system of draught.

In the Ferrando system the fire-bars are placed transversely in the furnace; they are very narrow, being only 7-16ths in. thick, and have air spaces between them of 1-10th in. width. The ash-pit is closed, and the air of combustion is supplied at a pressure equal to a head of [illegible] in. of water.

On this question the indefatigable devotion of Mr. Howden to its development cannot be passed over. We were favoured with a paper from that gentleman at our 1884 and 1886 meetings, upon which interesting discussions ensued; and we must all be gratified to know that his system has been very severely tested and systematically experimented upon in a large ocean steamer with, the writer understands, most satisfactory results. These trials were attended by Mr. Parker, and, we may be sure, would be carried out in such a manner, and with such intelligence and care, as to make them of the greatest value in the study and development of this, which, in the writer's humble opinion, is *the* subject of FIRST importance in the further development of marine engine progress, viz., the complete utilization of our fuel and the products of its combustion. The writer hopes Mr. Parker or Mr. Howden himself will during the discussion give an outline of the results obtained, if they do not at present feel themselves free to give full details.

Other systems of forced draught aiming at fuel economy have been used. In several cases they have been unsuccessful, and at present, the writer submits, should only be looked upon in this respect as experimental, rather than assured results.

The universal adoption of some system of artificial draught in war vessels is, in the writer's opinion, the prelude to its general adoption in the mercantile marine, where its advantages would be vastly more important and valuable. Some of these advantages he ventures to submit to the consideration of shipowners as follows:—

(I.) Reduced size and weight of boilers, with their contents, in the shape of many tons of water uselessly carried during the whole life of the ships, consequent on this increased space and capacity available for freight-paying cargo, as, for instance, affording the possibility of adopting single-ended, instead of double-ended boilers, by which not only the reduced cubic capacity of the boiler itself, but the whole of that of the stokehold, is made available for ships' use.

(II.) The maintenance of uniform pressure of steam under all conditions of weather or climate, or the working and cleaning of fires.

(III.) The complete ventilation of the stokeholds and the engine-rooms in hot climates and under all weather.

(IV.) Greater control over the whole of the operations connected with the generation and maintenance of steam.

Engineers are constantly asked, "Will it not be wasteful of fuel and shorten the life of the boilers?" The writer would unhesitatingly answer "No" to both these questions.

With regard to the first, due attention being had to the proper proportion of grate and heating surface and disposition of the same, no increased waste of heat should or will occur under ordinary careful management.

The durability of locomotive boilers, in which more than three times the quantity of fuel is consumed per square foot of grate than is usual in marine boilers, and in which the circulation of water is much less complete, and its quality generally much worse, is sufficient answer to the second question.

(To be concluded in our next.)

THE first sod of the Manchester Ship Canal was cut on November 11th at Eastham, by Lord Egerton of Tatton, the chairman of the directors of the company.

IN consequence of the great increase in the price of copper and spelter, Mr. Alexander Dick, of 110, Cannon Street, E.C., has been obliged to raise the price of his Delta metal ½d. per lb.

HAVRE MARITIME INTERNATIONAL EXHIBITION.—Messrs. Wm. Crichton & Co., Shipbuilders, Abo Finland, have obtained a Diploma and Silver Medal for their collection of models for shipbuilding.

AT the recent Maritime and Industrial Exhibition at Havre, Delta metal was awarded a Gold Medal for the exhibits of propeller castings, forged cranks, pump rods and rams, torpedo shafts, driving gear, &c.

ASBESTOS COVERING.—Toope's Asbestos Covering Company, of Stepney, has received orders from Messrs. Humphreys, Tennant and Co., to cover all the steam pipes on H.M.S. *Victoria*, now fitting out at the Elswick Works, Newcastle; also those on H.M.S. *Sans Pareil*, now fitting out in the Victoria Docks, with its new patent fireproof removable covering, consisting of asbestos sheathing and pure asbestos fibre filling, with an outer coating of best canvas and painted.

THE FASTEST BRITISH WARSHIP.

IN our September issue we gave an account of some preliminary trials of H.M.S. *Galatea* in the Firth of Clyde, which were not quite completed owing to an accident to the valve gearing of the forward set of engines. The defects having been made good, and extra fittings supplied to reduce the vibratory motion of the slide gear, the vessel left the works of Messrs. R. Napier & Sons at the end of last month, and made a satisfactory run to Portsmouth, where her official trials have been carried out. The machinery of the *Galatea* and her sister ship, the *Australia*, marks an era in the British Navy, as the engines for these two vessels were the first of the triple-expansion type ordered by the Admiralty. When tenders were asked for by the Admiralty for the construction of ships of the belted cruiser class, the Admiralty proposed to fit the vessels with ordinary compound engines of 7,500 I.H.P., and not exceeding 800 tons in weight. The great success that attended the adoption of triple-expansion engines in the s.s. *Aberdeen*, induced Mr. Kirk—whose claim to the title of being the inventor of this type of marine engine is undisputed—to offer to the Admiralty to construct triple-expansion engines that would occupy no more space, but would indicate 1,000 I.H.P. more, with a total weight of only 770 tons. His offers were accepted, and the result of the official trials of the *Galatea* at Portsmouth have more than fulfilled Mr. Kirk's anticipations.

The natural draught trials—or, to be officially correct, the trials with the stokehold hatches open—took place off the Isle of Wight on the 9th of November. The mean draught of the ship was 21 ft., giving a displacement of 5,000 tons, which is her designed load when fully equipped and manned for service. During these trials the fans were kept running at a slow speed for ventilating purposes, the pressure of air in the stokeholds never exceeding an eighth of an inch of water. Steam was easily maintained in the boilers, the average pressure for the four hours being 129·8 lbs. The mean speed of the two sets of engines was 101·15 revolutions per minute, and the mean vacuum was 27·73 in., which is highly satisfactory seeing that the air-pumps are horizontal. The H.P. developed was 5,857·99, or about 860 above that stipulated for; and the speed of the vessel with this power taken from six runs on the measured mile in Stokes Bay was 17·397 knots, or nearly a knot more than has been obtained with any other vessel of this class. The forced draught trial took place on the 11th of November in the Solent, in the presence of Mr. Sennett, the engineer-in-chief of the Navy, and a large number of distinguished officials and visitors. After testing her steering qualities by turning circles at full speed [the Steam Steering Machinery, which is of novel construction, was manufactured by Davis & Co., Limited, Poplar, London, also worked well and smoothly], a four hours' trial with the stokehold hatches closed took place, during which a series of runs on the measured mile proved the *Galatea* to be the fastest ship in Her Majesty's Navy, her mean speed with her full displacement being 19·008 knots, or more than a knot per hour over the designed speed. This speed has been often exceeded in the small torpedo craft of our own and other Navies, but there is only one other large warship afloat that can leave the *Galatea* behind when she is putting forth her best energies. We refer to the cruiser *Reina Regente*, built by Messrs. J. & G. Thomson, of Clydebank, for the Spanish Navy, whose official trials took place last month on the Clyde, when a speed of 21 knots was obtained. During the run of the *Galatea* under forced draught, a mean pressure of 138 lbs. was kept in the boilers; and with a mean vacuum of 27·16 in., and a mean speed of 113·5 revolutions, the H.P. developed was 9,204, or over 700 in excess of that guaranteed by the contractors. Steam was blowing off the whole time at the safety valves, and as the air pressure in the stokeholds was only equivalent to one inch of water, it was more than proved that there still existed a large reserve of power in the boilers that could not be utilized in the engines. The maximum power obtained was 9,660, and when the actual weight of the machinery is considered—the 770 tons including the weight of the water in the boilers and condensers—it will be seen that the greatest skill and care must have been exercised in the design of the machinery to have produced these eminently satisfactory results. Mr. Kirk was heartily congratulated by all present on the great success attending the trials, there having been not the slightest hitch or trouble with either the engines or boilers throughout.

During each of the four hours' trials the coal was most carefully weighed; and the consumption per I.H.P. under natural draught was 2·3 lbs., while under forced draught it was only 1·97 lbs. If the grate area were reduced in the *Galatea's* boilers, it is more than probable that the consumption of fuel per I.H.P. under forced draught, would not exceed the best results yet obtained in any other ships. When working under natural draught the temperature in the stokeholds was between 140° and 150° F., while under forced draught the stokeholds were pleasantly cool, the temperature being between 90° and 100°. The fans for producing the air pressure being placed on the crown or roof of the stokeholds, all the small dust and ashes were kept down on the plates, the consequence being that the air was much purer, and the men not blinded or choked so much as when the hatches were open. This was palpably evident from the appearance of the men who were on the fires during the trials, they being less black after the forced draught trials than after the ordinary trial, although they had fired nearly double the quantity of fuel in the same time. One fleet of merchant steamers, running to China from Liverpool, has gone in strongly for the Navy plan of closed stokeholds; and in addition to finding that it produces a very appreciable economy of fuel, the owners have found that they can command much greater regularity, as steam is maintained independent of climate or weather. That it conduces to the greater comfort of the firemen, even in such places as the Red Sea, is evidenced by the constant applications the owners receive from their firemen to be transferred from vessels that have open stokeholds to those fitted with closed stokeholds.

LISHMAN'S PATENT STEAM GENERATOR.

THIS invention, which is being fitted to the boilers of the *Sunshine*, a steamship of 800 tons, was satisfactorily proved the other day by the Lishman Steam Generator Company, of 2 and 3, Victoria Mansions, Victoria Street, Westminster, S.W., at the Globe Rope Works of Messrs. Hawkins & Tipson, Millwall, E. There was a numerous attendance of engineers and others, Lloyd's Register of Shipping being represented by Messrs. Martell and Parker. In the absence of an illustration, a popular definition of the invention is—first, a boiler fire-box, without furnace bars or ashpit, with, in place thereof, a long tue-iron of peculiar construction, extending into a mass of coal; second, a feed-water system, encasing this tue-iron, whereby feed-water may be afterwards delivered at any practicable temperature, and at any desired level, into a boiler. This popular definition of the combined operation of supplying heated circulating feed-water to a boiler, whether land or marine, and of supplying forced draught for combustion after the manner of a blacksmith's hearth, calls for little explanation. The hollow tue-iron receives a cold air blast from an ordinary steam-driven fan or blower, and being in a heated state within a furnace, the blast which it delivers from a number of apertures into a mass of coal is now necessarily heated air, and therefore it is helpful to combustion. On the other hand, cold feed water descends upon this tue-iron, and while encasing it, is, in special tubes, exposed to the all but incandescent heat of a blast furnace before it passes to the boiler, in, it may be, a gaseous form, to the production of boiler steam, with extreme rapidity. Such are the essentials of the invention, and to the marine engineer, as to the land engineer, they are innovations of a high order of importance. There is no complexity about them. They may be applied at once, at small expense of fitting, to any boiler in present use, and doubtless with a variety of modification and improvement in detail. Whether clinkers may or may not be readily removed by this or that arrangement is of such detail. So, also, is this or that provision for the circulation within the boiler of the heated or gaseous feed water. Whether, also, the tube blast outlets into the mass of coal will burn away in a month or in a year, under constant marine steaming, is a matter for determination under actual steaming trial, with doubtless subsequent suitable provision against burning, should inconvenient burning be experienced. Similarly with the burning of the feed-water tubes exposed in the furnace. The invention, in a word, is a forward one, one that there will be no ignoring, one that speaks for itself, and which may as well be accepted sooner than later, and made the most of both on sea and land. Improved, as before remarked, it may be; but, obviously, Mr. Lishman, in name and in fortune, let us trust, will continue to be associated with a remarkable simplification of forced draught for combustion, and for rapid steam generation by his heated feed-water.

Having said so much in commendation of the invention, it will not have escaped the notice of the marine engineer that whatever the evaporation of water by a fixed quantity of coal, a de-

duction will require to be made for the steam required to drive the fan, and supposing, by way of simple illustration, that from a fixed quantity of coal there is an evaporation of two pounds of water, but that one pound of this evaporation is required to drive the fan, then the net result available for other uses is only one pound of evaporation instead of two pounds. This is the sole objection that can be urged, and against it there is the undoubted gain just mentioned, namely, that of rapid steam raising, by the simplest of all agents, the blacksmith's fire hearth. Then it is not to be overlooked that of late years so great has been the improvement in fans, that if they are not now altogether self-driving, their frictional resistance is at length so small that the deduction of evaporation for fan driving is a small quantity, as it is also a measurable quantity. Various facts were placed before the visitors at the Globe Rope Works on the occasion of the demonstration. First, there was a black and white drawing of the Lishman patent boiler, with its appliances for the generation of heat at will under pressure, and for the utilization of the whole heat so generated. As shown, the heat is evolved by means of an apparatus, which consists of a blower, a water circulator or vaporizer, and feeder combined. This apparatus, which may be nearly the length of an ordinary furnace, may be placed in a combustion chamber, or close furnace, without grate, fire-bars, or ash-pit, and the heat therefrom may be developed in proportion to the quantity and quality of the fuel used, as also in proportion to the pressure and quantity of the air blown. The supply of fuel and air being in accordance with the work to be done the combustion may be so perfect that with a complete absorption of the carbon of the coal as carbonic oxide, there will be no smoke, and therefore no occasion for a chimney shaft. The heat evolved passes through three longitudinal combustion flues and steam generators which are in connection by diagonal tubes. From the upper combustion flue the waste heat and gas pass to the feed-water tank, and are there utilized. The apparatus of combustion, stimulator, vaporizer, and feeder may be readily applied to marine and other boilers. Already it has been tested upon Cornish and Lancashire boilers with astonishing results. In one case, by the use of the apparatus, one ton of common duff coal, at 9s. 6d. per ton, has generated as much steam as two tons of good bituminous coal at 16s. 9d. to 18s. per ton. The engineer's report, vouching for this fact, also shows that with the apparatus, one pound of the better quality of coal evaporates 12·3 lbs. of water, and one pound of inferior coal 9·27 lbs. of water; whereas, without the apparatus, one pound of the better quality of coal was burnt for the evaporation of only 5¼ lbs. of water. The drawing further set out a sectional plan of the boiler, a vertical section also, through the upper and lower combustion tubes, showing, in addition, the steam chest and feed-water tank, with boiler in front and transverse elevation. The combustion apparatus or vaporizer consists of two rectangular or circular tubes, with an air channel between. The air channel is connected in front of the boiler with a blast pipe, and the tubes on each side of it through which water circulates are provided with small transverse tubes or orifices through which air is blown into the mass of coal. The egress of the resulting gas is retarded by a valve or damper. Air is also admitted at the back of the bridge of the furnace, as further conducing to thorough combustion and an absorption of smoke. Remembering that in blockade running, during the American war, smoke emission was the constant tell-tale, the invention obviously points to an early entrance upon a smokeless marine era. An early trial by the Admiralty on a torpedo or other vessel should be pressed by Mr. Lishman and his friends.

THE prohibitive tariff of Russia, which comes into force with the beginning of next year, is already showing its effect in various manners; thus the Motala Engineering Company, Sweden, which had secured a contract for two steamers from a Russian firm, have had the order countermanded, as the steamers could not possibly be delivered within the present year, and the duty would be too high according to the new tariff.

NEW ATLANTIC LINER.—Messrs. Laird Brothers, of Birkenhead, have been selected by the Hamburg-American Company to build for their Hamburg and New York express passenger service a steamer of nearly 7,000 tons. The vessel is to be constructed of steel, with a complete double bottom, and is to be subdivided into not less than ten principal watertight compartments. Her engines are to be twin-screw, of great power, and arrangements are to be made for insuring the *maximum* of security with comfort for passengers.

MESSRS. JOHN SPENCER & SONS' EXHIBITS AT THE LATE NEWCASTLE EXHIBITION.

MESSRS. JOHN SPENCER & SONS, of the Newburn Steel Works, Northumberland, had a large number of most interesting exhibits at the Newcastle Exhibition, both outside in the north gardens and in the north court of the principal Exhibition buildings.

Glancing first at the outside exhibits of this well-known firm, who have for nearly a century been engaged in iron and steel manufacture, we notice several of the largest are of patterns of the large steel castings manufactured by Messrs. John Spencer and Sons, to the order of Palmer's Shipbuilding and Iron Company, Limited, for the belted cruisers H.M.S. *Orlando* and *Undaunted*.

The use of castings in the place of forged material has been gradually increasing for some years, a great impetus being given to the change by recent improvements in the method of casting. It has even been anticipated that cast steel would displace forged iron in the stern frames of ordinary mercantile steamers; but however it may be in the future, this has not as yet been generally realized. No doubt the cost of pattern making (a separate pattern and mould being required in practice for every stern frame) militates against the abandonment of forgings for castings; but the stems and stern frames of war vessels, owing to their constantly varying sections of material, and the accuracy with which curved lines have to be introduced with intricate set-offs, together with branching connections, can now be produced as steel castings at much less cost than when forged, despite the heavy expenses of making a complete pattern.

In a certain class of mercantile steamers, it will usually prove advantageous at least to have the stem of cast steel. Those who have had experience with the stems of flat-plated keel steamers, know well what anxiety there is connected with them, as to whether they are made correctly and according to instructions, and as to the difficulty of getting them accurately into shape when being bent on the blocks in the shipbuilding yard. In future it would seem there need be no such anxiety, as the casting of these parts has been brought well nigh to perfection. Some account of the process of executing these large castings may be of interest. Full-sized drawings on thin boards, with sections, were prepared in the moulding loft at the shipbuilding yard, and from them the moulds for the castings were made. In the case of the propeller shaft brackets, to ensure absolute accuracy a template was prepared by the shipbuilders, and tried in place, after the stern frame of the *Orlando* had been erected, and before the moulding or casting of the brackets had been put in hand. The accuracy with which the moulds, and subsequently the allowances for contraction of the castings in cooling, were made, is evident from the fact that there was practically no chipping or hammering necessary when the finished stem, stern frame, and propeller shaft brackets were delivered into the shipbuilder's hands. The stem of these vessels is of the ram type, the lower portion only being of cast steel. The upper portion of an ordinary bar section, with the fore end swaged, was forged at the works of Palmer's Shipbuilding and Iron Company, Limited. Throughout the greater portion of the stem casting there are two moulding edges, so that the shell plating might make a flush finish, obviating the necessity of thinning away the edges of the shell plating, where they overlap and abut on the stem.

The stern frame is of even greater intricacy in its construction, despite the absence of curvature. Palms projecting on each side, provided for effecting connection with the propeller shaft brackets, add materially to the difficulties of the casting. In the case of a forging, it would be extremely difficult to make sound and accurate work, since the irregular and frequent heating and cooling cause initial strains to be set up, which even careful annealing will not remove, while such treatment damages and destroys the fibrous nature of the material. The subsequent machining, which occupies much valuable time, and necessitates the use of large and expensive tools, renders the comparative cost of forging much more excessive than that of steel castings. The total weight of the stern frame casting, in each of the belted cruisers, was 8 tons 6 cwt.; and of the stem, over 4¼ tons.

The propeller brackets, which, when placed in position, have the centre of their eyes 10 ft. from the centre-line of the vessel, are also important and intricate castings, each of which exceeds 8 tons in weight.

In Figs. 1, 2, and 3, we illustrate a cast steel tiller, which is one of the specimens of actual work Messrs. John Spencer & Sons exhibited at their outside stand. It will be observed it is of the

quadrant type, and has two arms placed at angles 72 degrees apart. It will be noticed from Fig. 2 that the section adopted allows of ample strength with a *minimum* of material; while from Fig. 3 it will be seen that the upward bends of the arms are such that, as forgings, quadrant tillers of similar design would be very costly. Viewed from any aspect these cast steel quadrant tillers are an advance on those of ordinary construction—in which the rim is usually built of plate and angle irons, and riveted together. The cast steel tiller we now illustrate is only one of many that Messrs. John Spencer & Sons have constructed, and we shall be surprised if it will not be found advantageous to all shipbuilders to uniformly have steel cast quadrant tillers, instead of forged and built iron ones. Their absolute soundness is no doubtful matter, as the severity of the tests for all steel castings intended for vessels building to the requirements of Lloyd's Register is well known. In the case of each of the large castings already referred to, each of them was drop-tested, by lifting it up with a steam travelling crane to a considerable height. It was then allowed to fall upon a macadamized road surface. Each of them was also lifted up, having one end resting on the road, and the other end forming an angle of sixty degrees with the surface of the road, and dropped from this position. After being subjected to these severe tests, each casting was

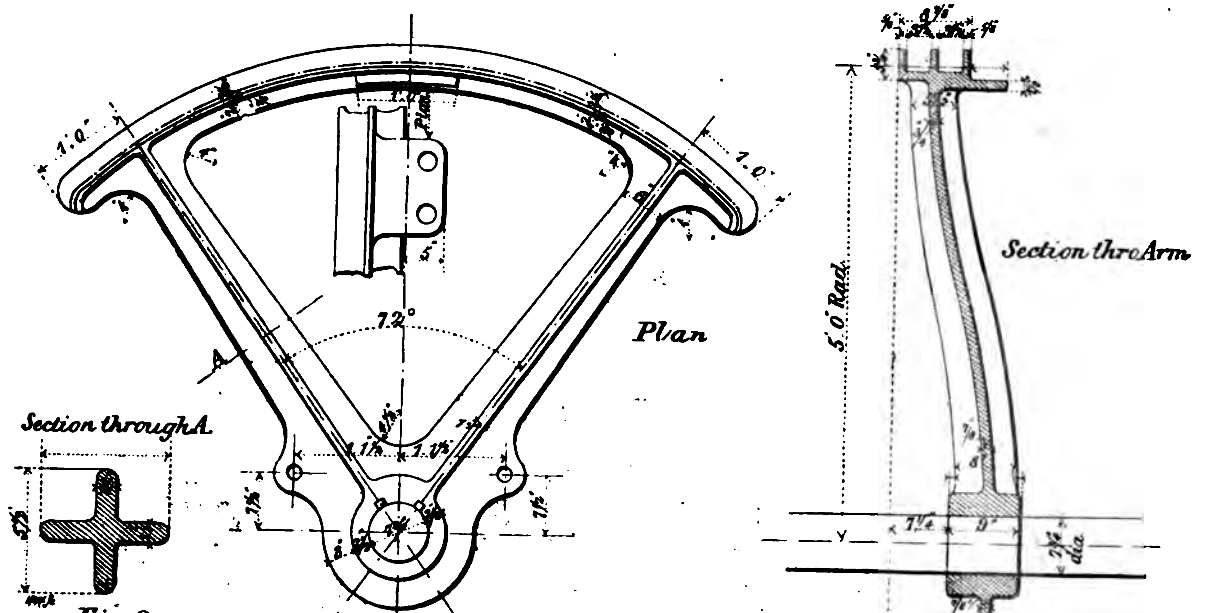


Fig. 2. Fig. 1. Fig. 3.

MESSRS. JOHN SPENCER & SONS' EXHIBITS.

suspended, and hammered with heavy hammers to try its soundness; and in every instance with satisfactory results.

The test of cast-steel tillers are also very stringent, comprising a strain applied torsionally, capable of twisting off the head of a forged-iron rudder-post of the full diameter; then a free fall through 10 ft. on to a macadamized road; and, subsequently, a severe hammering all over, besides the satisfactory testing of a tensile test-piece.

Another interesting exhibit was the pattern of a 13 in. diameter marine crank-shaft, which has been used for several vessels, one of which in April last had run a mileage of upwards of 110,000 miles; and concerning several of these shafts the superintendent engineer reports that "he can note no change in their character from the first." Mr. J. W. Spencer has for several years advocated the advantages of an unhammered steel casting for crank shafts, and many engineers are now of the same opinion. Especially for the largest sizes is it claimed that a cast-steel shaft is vastly superior to a forged-iron crank-shaft, and at least equal to, if not superior than a forged steel shaft. Certainly the appearances both of machined, bored, and fractured surfaces to be seen at Messrs. John Spencer & Sons' stands, appear to bear out Mr. J. W. Spencer's contention. After all, forging is an unscientific way of treating any material, since it interrupts and destroys the continuity of the crystallization of the structure, takes away its homogeneity more than annealing can compensate, and by frequent unequal heating and cooling loosens the molecules, and also introduces injurious elements; while the physical and mechanical conditions of a properly treated cast shaft is that of a state of quiescence, so that it is quite free to do the full work of resistance.

Even additionally interesting as illustrative of the qualities of cast steel, was the thrust shaft exhibited, cast to shape, and afterwards tested to illustrate to Lloyd's Register the quality and strength of the material. It was broken by dropping a weight of 60 cwts. upon it 80 times from a height of 50 ft.; and the fractures displayed great homogeneity in the material.

Wasteneys Smith's well-known patent stockless anchor, and a sample of Penman's weldless chain, which we have so recently described, were also amongst the outside exhibits of Messrs. John Spencer and Sons; as well as patterns of propeller blades, &c. One of the propellers is of a form which only some of our readers will be acquainted with. We refer to Davidson's patent propeller, which in Fig. 4 and Fig. 5 we illustrate. It has, we believe, been designed to secure greater efficiency, by reducing slip; a greater effective surface being obtained by the corrugations without increasing the diameter of the propeller, or widening the blades. So little comparatively is known of what constitutes the most suitable and economical design of a propeller for a screw steamer, that any experiment in this matter should be welcomed. We understand a number of Davidson's patent propellers have been fitted to north-east coast steamers; and we will in the course of time be glad to learn with what results.

We now turn our readers' attention to those exhibits Messrs. John Spencer & Sons had at their stand in the North Court.

Necessarily the vast variety of work that such an establishment as the Newburn Steel Works turns out includes many articles not of special interest to our readers; and we can only refer to such *en passant*. Amongst the exhibits of general interest we cannot, however, overlook a beam weighing 10 tons for the carriage of an 120 ton gun; a similar exhibit, weighing $2\frac{1}{2}$ tons for the carriage of a 40 ton gun; and a complicated girder for a Vavasseur gun carriage, all of which are bored and machined to show their soundness, and speak volumes for the perfection to which Messrs. John Spencer & Sons have brought the art of steel casting. We understand that but for the want of space, recoil cylinders, clipracers, and many other special details in this department would have been shown. A few specimens of steel shot and shell illus-

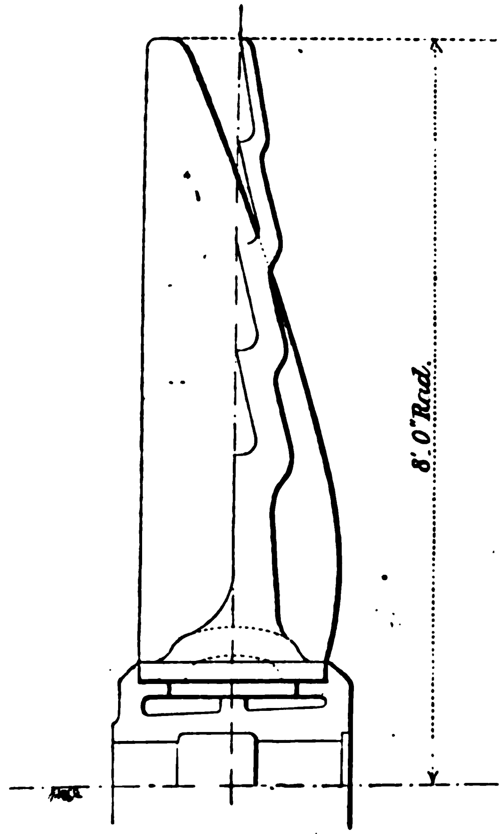


Fig. 4.

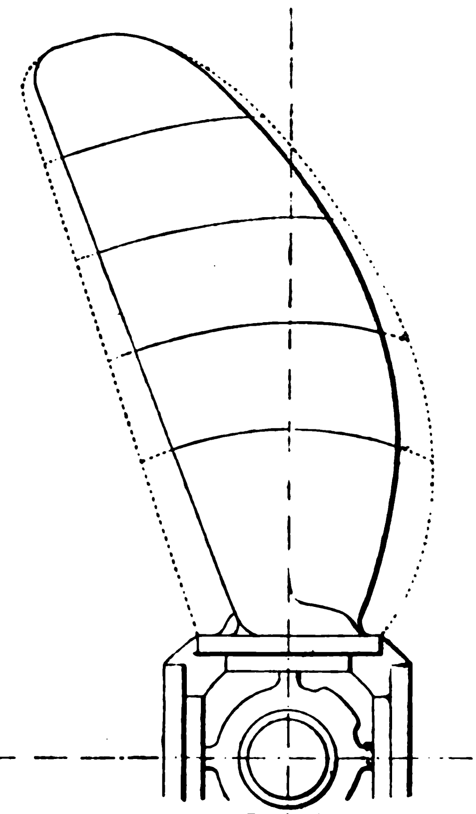
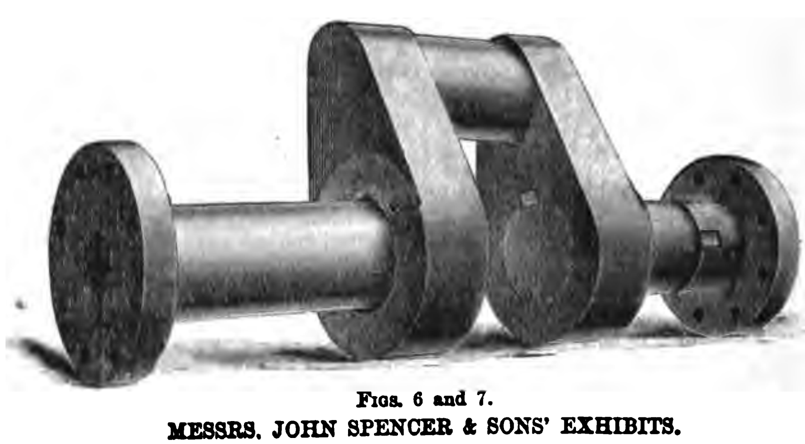


Fig. 5.



FIGS. 6 and 7.

MESSRS. JOHN SPENCER & SONS' EXHIBITS.

trated a branch of trade which, during the last few years seems to have been monopolized by foreigners. Our government prefers to follow their experience rather than encourage our own manufacturers, not a very patriotic, or safe policy! Sheffield has, however, at last obtained a footing, and it is to be hoped Newburn will also, as Messrs. John Spencer & Sons are prepared to supply shot and shell equal in penetration, or any other point of efficiency, to any manufactured at home or abroad, either as castings or forgings.

The armour plate exhibits of this Newburn firm were also important. A piece cut off an armour plate intended for the glacis, surrounding the turret of one of the large Italian ironclads now being built, should not be overlooked; nor a section of an armour plate of unhammered cast steel, 4 ft. 4 ins. long, 12 ins. thick. The appearance of the machined surface and fracture of this armour plate, as well as that of a length of tube, 5 ft. 4 ins. long, 21½ ins. outside, and 12 ins. inside diameter, bored and part turned, but fractured at top, show the quality of a material which Messrs. Spencer claim as equal, if not superior, to the hammered and unequally strained armour plates or gun tubes hitherto so largely used.

This firm appears to be determined to prove the value of cast steel for armour plating and gun tubes—and they deserve success. We trust it will not be many months, ere they succeed in convincing the Admiralty of the value of their manufactures in this department, and we await with interest the outcome of the trials of a cast steel armour plate, weighing upwards of 10 tons, which is ready for trial by our Admiralty authorities.

In describing the exhibits of Messrs. John Spencer & Sons, we labour under great difficulties, as they were illustrative of so many departments. We have already referred to their steel castings in the heavy and light shipbuilding, marine engineering, and armour plate requirements; but, in addition to further specialities in marine engineering, they had a very vast and varied selection of exhibits for hydraulic purposes; rolling mills; steel works; collieries; locomotive and railway requirements; ship smiths' work; springs of all kinds; tools, &c., so that a mere enumeration is impossible in our limited space. There are, however, some specialities in which our readers will be interested, which in the remaining portion of our notice of Messrs. John Spencer & Sons' exhibits, we will endeavour to describe fully.

Foremost in this category we place Mr. H. Foster's patent crank shaft. The method of making new crank shafts devised by Mr. Foster, is also applicable to the repairing of ordinary broken crank shafts, and although it may possibly be considered especially advantageous in the last-mentioned instance, it may not improbably be brought into extended use for new crank shafts.

It is well known that the breakages of crank shafts almost invariably occur either in the crank-webs, or, at the angle formed by the junction of the crank-pin and crank-web, where a forged iron crank-shaft is most likely to be defective, and where the change of form of the shaft throws great local stresses on the material.

These breakages are evidently due to the shafts getting out of line, and on the slightest indication of fracture at the points mentioned, the shaft although perfect in all other respects, has hitherto been condemned as useless, and another entirely new shaft substituted, involving considerable outlay, only to be repeated on another indication of a flaw, and in certain types of engines, crank-shafts have had to be renewed again and again within a few years.

In the method of making crank-shafts here illustrated, the crank-pin (C) and the two crank-webs (D, D), Fig. 6, are cast in one piece of mild steel, which, after being heated, are shrunk on to the lengths of shaft (A, B), and aftewards further secured by means of keys (E, E), the complete crank-shaft being shown in Fig. 7.

When crank shafts are thus made they are essentially built shafts, without the disadvantage of having a large amount of unbalanced material at the crank pin end of the webs, and should fracture occur, instead of throwing away the whole shaft, only that portion to which the fracture is confined need be replaced, which can be done at a trifling cost compared with that of a new crank shaft. In cases where ordinary crank shafts, made from one solid piece of metal, have become fractured at the crank pin or crank web, and have, in consequence, been condemned as useless, the ruptured webs and pin are cut off, leaving the shafts (A and B, Fig. 6) as shown with bosses where the crank webs have previously been, another crank pin (C), with its crank webs (D, D) all cast in one piece, being substituted and shrunk on the shafts A and B, and further secured by keys (E, E) as already described in the manufacture of new crank shafts.

The illustrations Figs. 6 and 7 are taken from photographs, and represent a large crank shaft for the "Monarch" Line, 16 in. diameter, 2 ft. 4½ in. throw, and weighing over 6 tons, which was repaired on Foster's patent method. This crank shaft being under the survey of the Board of Trade and Lloyd's, it was necessary that the new part should satisfy their rules, re tests for strength and ductility. For this purpose tensile and transverse test pieces were cut from the webs and tested in the presence of the surveyors, with the following results:—

Mark of Test	..	O 739	O 740
Size of Specimen	dia. inches	·753	·752
Original Area	square inches	·4453	·4441
Fractured Area	do. do.	·1555	·2248
Permanent set induced	tons per sq. inch	17·04	19·60
Maximum Strain	do. do.	27·34	33·18
Contraction of Area	per cent.	65·08	49·38
Elongation in Length of 5 in.	do.	24·5	18
Appearance of Fracture, silky	do.	100	100

Bending tests of pieces 1½ in. square iron were also made and bent through angles of 162 degrees and 168 degrees respectively before fracture.

The manner in which these repairs are executed leaves the finished shaft perfectly true in the lathe.

It is scarcely necessary to call attention to the saving effected by adopting this invention, enabling as it does whole crank shafts which have been condemned merely on account of a local defect, to be made practically new at a trifling cost. Messrs. John Spencer & Sons are the sole manufacturers of Foster's crank shaft, and great success has attended all the new and repaired shafts, constructed or repaired according to this method.

There was another speciality shown at the north court stand of Messrs. John Spencer & Sons, which we do not recollect having noticed before—viz., Johnston's patent non-corrosive metallic coating for propeller blades, for which the Newburn firm have the sole license on the north-east coast.

A propeller blade exhibited at their stand had about one-third of the blade from the tip end coated with Johnston's patent substance, which consists of tin or other suitable metal or alloy. This is applied in a novel manner. The surface to be coated is first prepared by being ground, so as to be quite clean and bright and free from oxide. After the propeller blade has been thus prepared, it is heated sufficiently to cause the alloy to adhere, a coating of about one-quarter of an inch being then applied, and becoming a portion of the blade. In cases where Johnston's coating has been used, it has been found to resist corrosion admirably, lasting three or four years—the propeller blades being then as good as new. Most of the large Clyde steamship companies have adopted it, and probably, if it were better known, and brought before the bulk of shipowners, it would obtain almost universal acceptance.

Australian Steam Navigation.—Negotiations which have been proceeding for some time past between the Australasian United Steam Navigation Company, Messrs. Howard, Smith & Sons, and the Adelaide Steamship Company, with a view to the regulation of the Australian steam coastal service, have resulted in an agreement which has just come into operation. The special object of the agreement is to prevent injury to the steamship owners by undue competition. The principal steamship companies have hitherto acted together, but there has latterly been some difficulty in the control of the different services beyond Sydney on the one side and Adelaide on the other. The Adelaide Steamship Company proposed to run their steamers on to Queensland, and Messrs. Howard, Smith, & Co. and the United Steam Navigation Company threatened to retaliate by extending their services further to the west. The agreement concluded provides that the Adelaide Steamship Company shall not go beyond New South Wales, and that the United Steam Navigation Company and Messrs. Howard, Smith & Sons shall not carry their services further on the other side than Melbourne and Adelaide respectively. Another object of the agreement is to regulate the departure of boats and the rates for passengers and cargo. The rates have been brought down by competition to a level at which they they are unremunerative. Some increase will, therefore, now be made.

EXHIBITS OF MR. W. ALLEN AT THE MANCHESTER EXHIBITION.

MR. WILLIAM ALLEN, [illegible] Union Brass and Iron Works, [illegible] Manchester, had a very [illegible] exhibits in the machinery [illegible], viz., that of chemical and [illegible] apparatus in the section devoted [illegible].

[illegible] the last-mentioned exhibits was [illegible] for chemical and sewage purposes, which [illegible] aniline, anthracene, alizarine, and [illegible]. Although somewhat beyond our ordinary [illegible] to Mr. William Allen's improved filter [illegible] prove devoid of interest to our readers. It [illegible] understood by saying that the mode adopted

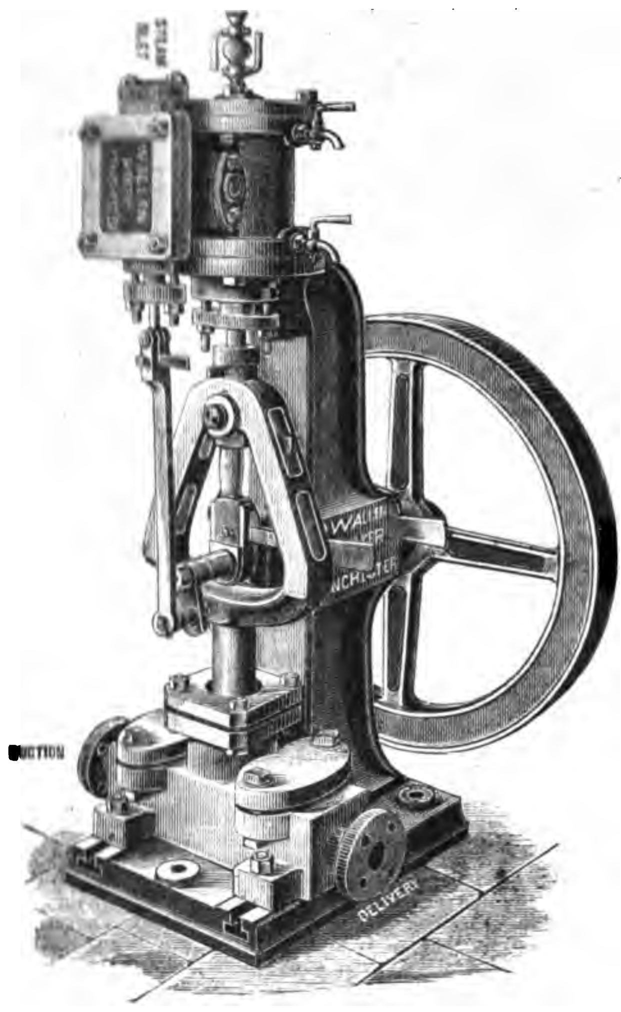


FIG. 1.

is exactly the reverse of filtering by hydraulic pressure. In the filtration of paraffin oils and such substances, where it is necessary to remove all the solid from the liquid matter, or *vice versa*, the old-fashioned mode was to fill filter bags with the substance, and put a number of them at one time in a hydraulic press, so that as the ram of the press forced the bags closer together, the oil, saccharine, or other matter, was forced out of the bags, while the solid matter was retained. Allen's filter press consists of a series of chambers formed by hollow plates, having filter cloths between each, and a common passage way leading to every chamber. The plates are all screwed tight against each other by a screw, worked by a large hand wheel. When the press is tightened up, a force pump, such as that shown in Fig. 1, and exhibited along with the filter press, or any other suitable force pump, is attached to the passage into the press, and the liquid or semi-liquid matter forced in through the channel. It is the pressure exerted by this pump that sends all the liquid matter through the filter cloths, the liquid running into the channels in each plate, and then being carried away through a cock connected to the bottom of each plate, while the solid matter is retained between the filter cloths in each hollow chamber.

It need scarcely be pointed out that this is decidedly an improvement upon the hydraulic press arrangement, and we can readily believe that substantial benefits accrue by the adoption of Allen's improved filter presses, such as reduced cost of plant, increase in the work done, saving of labour, less wear and tear of filter cloths, and in other important respects.

The donkey engine pump we illustrate in Fig. 1, as already indicated, represents one exhibited by Mr. William Allen. It has a ram 3 in. diameter, a cylinder 6 in. diameter, with a uniform stroke of 6 in. This size is capable of pumping 1,000 gallons per hour, and it is largely supplied as a boiler feed pump as well as a bilge pump, for which latter purpose it is equally adapted, as it has also been used with advantage in pumping pulp and thick and muddy substances in manufactures. As will be seen from our illustration, the working parts are all easily accessible, and care has been taken in designing it so that overhauling or repairing is facilitated. The clacks and seats have full areas, and in every case common bolts are used and not studs, a very advantageous arrangement in the case of a breakdown when skilled labour is not always available.

Mr. William Allen has been known for many years as one of the foremost Chemical Engineers of the country, and one of the latest of his numerous patents in this branch of engineering is his Patent Regulus Metal Cocks. The special advantages claimed for these cocks are that they are made entirely from acid resisting metals. They can be easily and efficiently burned to lead pipes, or are made with flanged ends to fit stills, &c., and will stand more rough usage than earthenware taps. The most important feature of these cocks is that they will not cut up when the plug is turned round, as happens in the old-fashioned antimony and lead cocks. Several Regulus plugs and seatings were also exhibited, as well as Mr. William Allen's improved acid egg valves for use on vitriol eggs. On the walls of this stand were also shown many photographs of acid blowing engines, &c., which have been manufactured by Mr. Allen, who has turned out over six hundred of his improved steam pumps for various purposes.

We would now draw our readers' attention to the same manufacturers' exhibits in the machinery section. Here Mr. William Allen exhibited the only pair of marine engines in the exhibition, and we illustrate them in Fig. 2. They are compound, with one high and one low pressure cylinders respectively, 12 in. and 20 in. in diameter, having 16 in. length of stroke. They were fitted up complete with propeller and shafting, the propeller being 6 ft. in diameter. The engines are of extra strong make, and are constructed from Mr. Allen's own designs, and possess many important improvements, amongst which may be mentioned the improved manner in which the reversing gear is constructed, it being fitted up with deep gun-metal bearings and studs in place of the ordinary joints and studs. The great wear and tear attending these particular parts of marine engines will show at once the importance of the arrangement. The general design of these engines of Mr. Allen's appears to be simple and efficient, and being open in the front, full access can be obtained to any part for disconnecting purposes, overhauling, &c. Another important feature is the arrangement of the steam supply pipes to the cylinders, whereby both cylinders can be worked at high pressure, which without doubt is found to be of great service in the starting of heavily laden river craft, for which these engines have been specially designed. On closing of a valve on the branch of the main steam pipe leading to the low pressure cylinder, that cylinder only obtains its steam in the ordinary method from the discharge of the high pressure cylinder, and the engines then work expansively (high and low pressure). The engines, being strongly constructed, are suited for high pressures of steam, and are intended for vessels of 300 to 500 tons burthen; and they are the only pair of full-sized marine engines in the Manchester Exhibition.

Another important exhibit of Mr. William Allen's is a powerful donkey steam pump, which we illustrate in Fig. 3.

This pump has a 5 in. ram and 8 in. stroke of extra strong make, designed to work at 75 revolutions per minute, at which speed it will deliver 2,500 gallons per hour. This pump is worthy of special notice, as it is thoroughly adapted for heavy work,

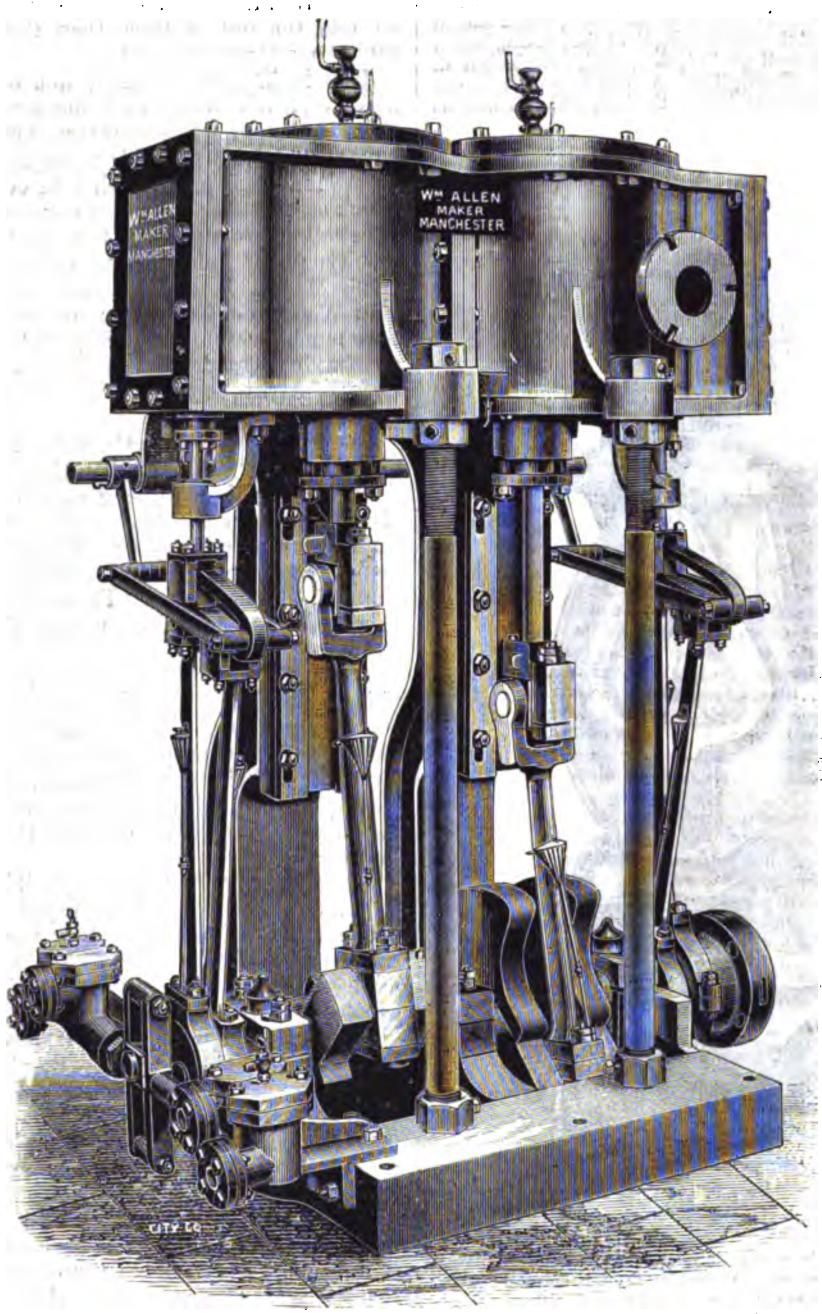


Fig. 2.

EXHIBITS OF MR. W. ALLEN AT THE MANCHESTER EXHIBITION.

such as pumping foul bilges in steamships, and it has also been found to be of extreme utility in chemical and other works, where no special care can be bestowed upon the pumping machinery. The simplicity of its construction and its many advantages render it suitable for rough work. Amongst the important features this steam pump possesses, we single out for mention the following—viz., the full area of the valves, the valves being the same area as the ram, the use of common bolts instead of studs, an arrangement which proves invaluable in case of accidents, when skilled labour is not available, and the unusual depth of the packing boxes, allowing of them being well packed, frequently overlooked in designing pumps of this description. As will be seen from our illustration the columns are attached to the bed, which is used as

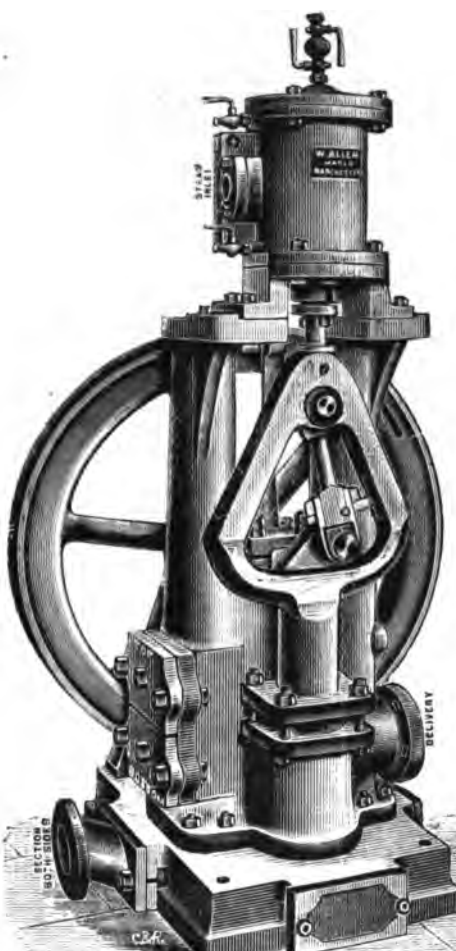


Fig. 3.

a cistern, having a supply connection on one side and a delivery on the other. There is an extra branch on the left column for fire extinction, sanitary purposes, &c., as may be arranged.

Mr. William Allen also exhibited in a glass case a large assortment of his well-known gun-metal steam fittings, which include improved sight feed lubricators, gun-metal marine safety-valves, steam-pressure gauges, valves, cocks and fittings. There was also on view at this stand improved cast-iron steam and hot-water valves and cocks. All the exhibits of Mr. William Allen are deserving of the highest commendation for their first-class design, and for the high character of their material and workmanship, and fully maintain the reputation that Mr. William Allen has for many years had as one of the first and largest manufacturers in the country.

HAY'S WATERPROOF MARINE GLUE.

Among the many small articles of detail that in the aggregate form the perfect whole, there is probably not one that has better withstood that most searching of all tests, the test of time, than the article forming the subject matter of this notice.

This is in great measure due to the fact that the makers (Hay's Waterproof Marine Glue and Varnish Co., Limited, of Chandos Street, Landport, Portsmouth) have spared neither trouble or expense in their efforts to ensure that their products shall be of the *best* only, a fact which accounts for their ever increasing use.

Selecting promiscuously from a large number of testimonials placed before us, we notice that on June 23rd, 1886, Messrs. R. and W. King state, "We have used your Waterproof Glue on all our vessels since 1863, and have much pleasure in stating that we found the same all that can be desired for vessels trading to the West Coast of Africa, more especially for use in the seams of the decks."

The Union Steamship Co. write, stating that they cannot give better testimony than that they, after 21 years, are still using the marine glue, and that it continues to give them every possible satisfaction. Further, we may state that the company manufacturing the glue have for many years supplied H.M's. dockyards, the Austrian, German, French, and Prussian Governments, the P. and O., and many other large firms of owners and builders.

The wonderful adhesive powers, coupled with its flexibility and durability, give the marine glue a great superiority over pitch for paying ship's seams, and a variety of other purposes in connection with the construction of buildings, pier works, and bridges, and here we may state that it has recently been used by the North-Eastern Railway Co. for caulking the High Level Bridge over the Tyne.

Its great advantage to shipbuilders lies in the fact that after a seam has been payed with it, it is only necessary to run a chisel along the seam, when all the surplus so saved may be re-melted for use, whereas with pitch all the surplus is scraped off and wasted. This, coupled with the fact that while its first cost is very little greater than the best pitch, it has in many instances proved itself of six-fold greater durability, leads us to the conclusion that it is much cheaper and more satisfactory to all concerned to use marine glue in place of even the best of pitch. Further, and this is of great importance on board yachts and passenger vessels, the glue is free from the disagreeable odour which is invariably present with other substances, while it is not liable to injury from damp, cold, or even the most severe frost, nor does excess of heat affect it, specimens that have been in use for the past ten years being now in good condition.

It is peculiarly applicable for use on board steamships, as is well shown by the following report by Capt. Inglis, of the *Edinburgh Castle*, to the owners: "The patent glue we got for our main deck is a very great improvement over the best pitch. Our seams are at present as full as when they were finished. It always keeps pliable; although the sun softens it, it does not get hard like pitch. Our waste water from the condenser, although very hot (and we had often to let it run on the deck), had

no power upon the glue; if it had been pitch it would have been taken out of the deck."

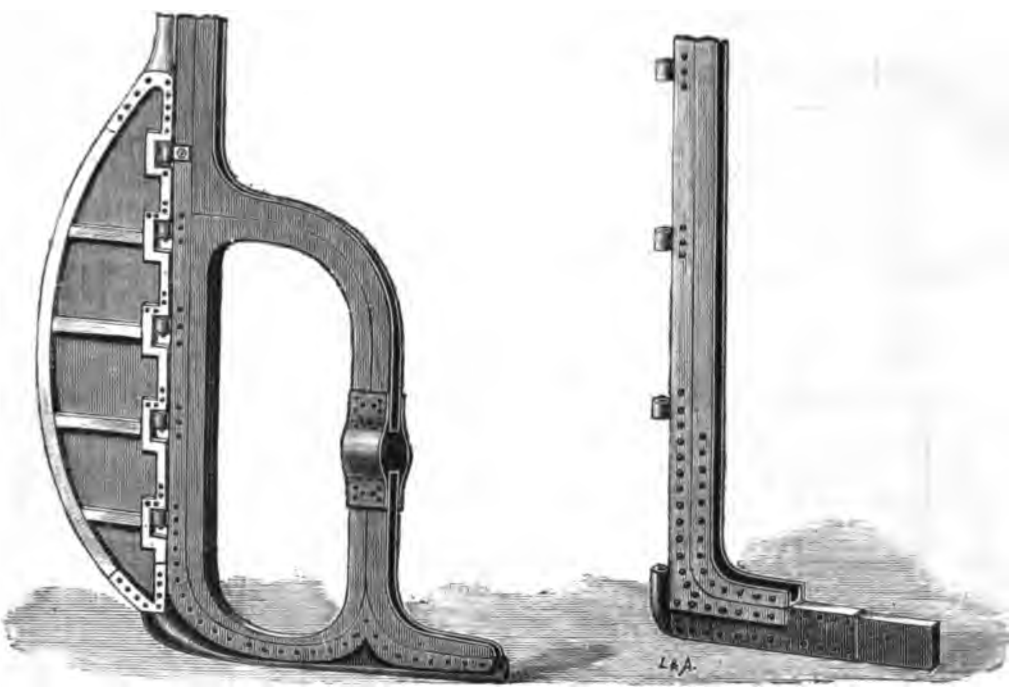
With such overwhelming testimony in its favour, we can only say that Hay's Waterproof Marine Glue is evidently the best thing of its kind now before the public.

The same company are also the manufacturers of several varieties of black varnishes, which are of the same high standard of excellence as their better known marine glue. These are specially prepared for use on iron work, in-board and out-board ship work, fittings, &c., and are giving every satisfaction wherever used.

LAIDMAN'S PATENT STERN AND RUDDER FRAMES.

THE accompanying illustrations represent improvements in stern and rudder frames, as recently patented by Mr. Jas. H. Laidman, foreman to Messrs. Earle & Co., the well-known shipbuilders of Hull.

As will readily be seen, the increased flexibility over a solid forging, or rigid casting, renders a frame constructed in accordance with Mr. Laidman's invention less liable to fracture than a solid frame, while should such fracture occur, as they generally do at the bottom, and in wake of the aperture, the sole piece could be liberated and repaired, or renewed at trifling cost, as compared with the expense of removing the entire stern frame as would have to be done in the case of a solid forging or casting. This method of construction also allows of the rudder pintles and gudgeons being "re-bushed" with economy and dispatch, as spare pintles and gudgeons could be carried, as also a spare sole piece, on board vessels making long voyages. In the construction of his stern post Mr. Laidman uses double channel bar, or, in other cases, I girder, made of either malleable or cast steel the gudgeons and sole piece being formed of solid forgings, or castings, and riveted within the trough of the channel or girder bars. The curves forming the propeller space are made by simply bending the bars forming the post, and the shaft tube is held in position by its vertical webs being secured



LAIDMAN'S PATENT STERN AND RUDDER FRAMES.

In designing the present form of frame, the inventor has sought to bring these important parts more into accord with the rest of the structure than obtains with the massive and unwieldly solid forgings or castings that are now so much in vogue.

By building up the frame as shown, greater dispatch in construction is obtained, as all the component parts can be under weigh at one and the same time, while sounder workmanship is obtained in the riveting of the stern shell plating to the stern post, a further advantage being that the continuity of the rolled steel channel bars is more to be relied on than the welded forgings generally employed, while, again, this method of construction effects a saving of 33 per cent. in weight, consequently giving increased buoyancy to the vessel.

to the channel bars forming the inner post, or by separating the bars vertically, and continuing them around the tube, which is then simply either a forged or cast steel ring, and connecting the same by riveting or screw studs. The whole stern frame is thus detachable, and repairs can be easily carried out, since the sole piece, each gudgeon, and stern tube collar may be liberated and replaced with great facility, a provision which allows of all ordinary repairs being carried out without the bodily removal of the frame.

The rudder frame is built up of channel bar, with a solid forged or cast rudder post, bifurcated to allow of the two branches being riveted within the main channel bar (cranked as shown to form recesses for the gudgeons) and the bow channel bar respectively, these, together with the

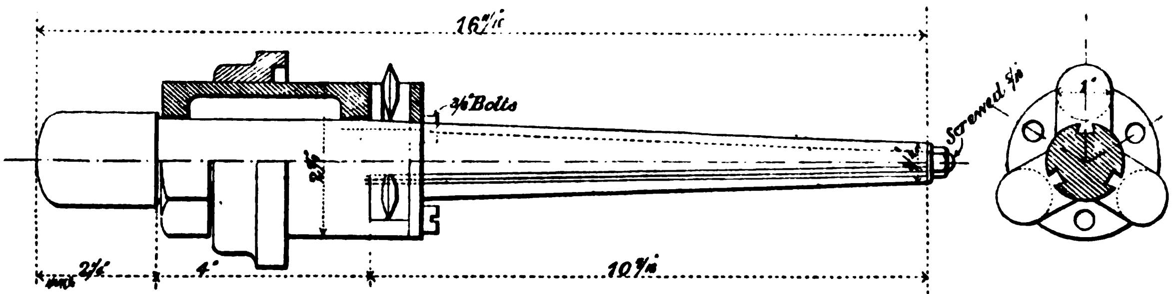
horizontal stays and solid forged or cast heel piece forming the foundation on which the plates are secured. The heel pintle is part of the heel piece, each intermediate pintle being riveted within the cranked bends, as shown, so as to preserve a co-incident axis throughout. The "woodlock" pintle is formed upon the square portion of the inner fork of the rudder post, and the weight of the rudder is carried by the gudgeons on the stern post in the usual manner, the heel gudgeon being formed upon the sole piece.

The inventor informs us that this system ensures a saving of 20 per cent. on prime cost, the combination of the parts being such that an undiminished structural strength relatively with solid castings or forgings is maintained without the weight or dangerous rigidity of the latter.

The obvious advantages of this method of construction cannot fail to commend themselves to the favourable notice of ship owners and builders generally, and we trust that the invention will meet with the success that it well merits.

MARQUAND'S PATENT TUBE CUTTER.

THE patent tube cutter, which we now have pleasure in describing, is the invention of Messrs. Powell, Marquand & Co., Engineers, of Vienna Chambers, Bute Docks, Cardiff. The cutter is a tool having for its especial recommendation simplicity, combined with a great saving of manual labour and time. It is especially useful for the cutting out of tubes in boilers of the marine type. Hitherto the tools used for this purpose have been found either too clumsy, or too complicated and expensive. The accompanying sectional sketch will speak for itself as being worthy of especial notice from engineers.



MARQUAND'S PATENT TUBE CUTTER.

A tapered spindle, having dovetailed slots for three parts of its length, as shown. Within these slots slide small boxes, containing circular cutters, these being kept in position by the cap, which is secured to the box by set pins. When about to cut out a tube, the guide ring is set so that the distance between it and the centre of the cutters is equal to the thickness of the tube plate or length of tube required to be cut, of course, limited by the length of the box, the end of which is hexagon-shaped to take a spanner, which is used to revolve the cutters. The tapered spindle, first drawn out to its full length, draws the cutters within the box, and the box being inserted in the tube, the spindle is driven up with a hammer, which expands the cutters, and a few turns with the spanner cuts through the tube with astonishing rapidity, a box of tubes being cut out in one-third of the time ordinarily required. Any further information respecting this useful invention can be obtained from the patentee.

THE ELECTRANODE.

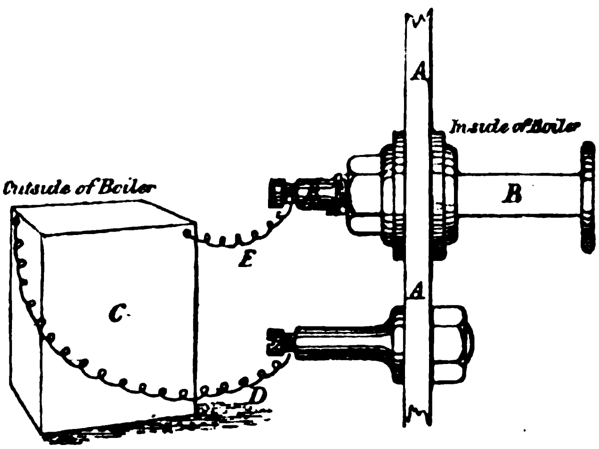
THE Patent "Electranode," the invention of Messrs. James R. Powell, Marquand & Co., Vienna Chambers, Cardiff, is an application of electricity for the purpose of preventing pitting or incrustation in boilers, and the removal of such incrustation which may have formed in the internal surfaces, and also other vessels subject to the action of corrosive agents.

A large number of steamships and stationary boilers have been fitted with the "Electranode," and the concensus of opinion, and the testimonials given by managers of works, consulting, and chief engineers, is that it is a decided success, and that it is a great boon to the users of steam. It effectually prevents the deposit of lime and other salts which form scale from adhering to the heating surfaces. The depositing matter, by the action of the "Electranode," is simply held in suspension, and falls by gravitation to the bottom in the form of mud, which, with the scale that has fallen off the surfaces, may be drawn out through the sludge-holes, and a great portion will have been blown out when the blow-cocks are periodically opened by the engineers during the working of the boiler. The cause of pitting, or corrosion, is without doubt due to thermo-electric actions, the cure being galvanism, or electricity, and that in preserving the internal surfaces of the boiler, it must be at the expense of an agent having a greater affinity for the corrosive matter. By the use of the "Electranode" the corrosive action is diverted from the boiler to the generator, which is constructed of such size and power as to permit of considerable reduction before renewal becomes necessary, and which can be replaced at a small expense compared with the cost of cleaning and repairs otherwise rendered necessary in a greater or lesser degree.

A strong point in favour of the "Electranode" and an extended use of this clever invention, is that it will permit a further advancement in the direction of the economical use of steam power through higher pressures, which would have been either impossible or very much

circumscribed, as it is well known that increased pressure causes increased precipitation of the calcic salts which, as the temperature increases become less soluble, and followed by increased pitting or corrosion. Another important point is this, that local action and polarisation does *not* take place with this apparatus, there are no internal wires to become detached, and thus destroy its action. The "Electranode" is an external application, is automatic, and is always within view of the engineer, and can be renewed at any time without opening the boiler.

The "Electranode" is equally effectual in fresh as in sea water, and is therefore a suitable application to stationary, locomotive, and marine boilers. The boiler is equally protected when cold as when under steam, and



may, therefore, be left any length of time full of water, without fear of injury through corrosion. The mode of application will be understood from the following sketch :—A is a section of the boiler plate, B a conductor passed into the boiler, C is the pile or generator, D and E the wires conveying the current of electricity, E being attached to the conductor B, and the wire D attached to the shell of the boiler, or preferably to the iron bulkhead on which the generator C is fixed in the engine-room; this necessitates but one hole through the boiler. The economy, saving, and the manifest advantages of the "Electranode" are quite, we think, self-evident, and we learn that the patentees are continually receiving letters in praise of the invention, accompanied by orders from owners who have proved the practical value of the invention.

ADELAIDE JUBILEE EXHIBITION, 1887.—By advices just to hand, we learn that Messrs. Barnett & Foster, of "Niagara Works," Eagle Wharf Road, London, N., have been awarded Five First Orders of Merit, for Soda-water Machinery, Generating Carbonic Acid Gas, Ice Making Machinery, Mineral Water Bottles, and the "London-made" Syphons.

A GRAVING dock is about to be constructed at Barry Island, in the West of England, which, when completed, will be one of the largest in the world. It will be capable of taking in vessels 700 ft. long, and will hold 62,000 tons of water. The dock will be emptied of this immense quantity of water in four hours by one pair of centrifugal pumping engines. They will be the largest ever used in England for graving dock purposes, and will be made by Messrs. W. H. Allen & Co., of York Street, Lambeth, London.

A NEW TYPE OF TORPEDO BOAT.

THE defects of the old second-class torpedo boats have long been recognized at the Admiralty, where also the desirability of combining in one vessel the speed and power of a torpedo boat with the general usefulness of a pinnace has been felt. It is well known that the old boats are very crank, uncomfortable and wet at sea, the result of which is that they are unpopular in the service, and are never used except for torpedo practice. Two further evils arise out of this condition of things. In the first place, owing to the boats being out of service for comparatively long periods, when they are called into requision some defect or other is almost sure to manifest itself; and, in the second, their crews get out of practice. Then, again, the old boats have too narrow a beam to steer well, and this combined with their low freeboard, renders them not particularly safe in rough weather. These considerations have led to the desire for a torpedo boat which could not only be used as such when required, but which could also be employed for the general service of the ship, and, by the light of what was witnessed, it would appear that the Admiralty and the builders between them have succeeded in securing for our Navy such a craft as promises to meet the requirements of the case.

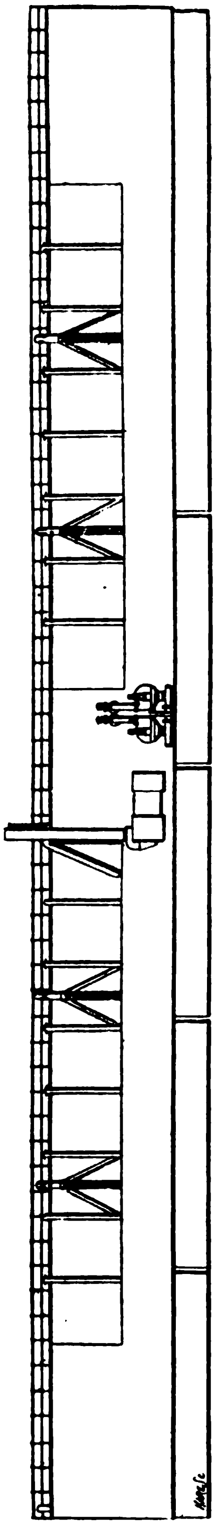
The vessel, which was tried on October 27th, is known as torpedo boat No. 50 on the official list, and has been built by Messrs. Yarrow & Co., of Poplar. She is somewhat shorter than the old boats she is intended to supersede, but she has increased beam and freeboard. She is 60 ft. long with 8ft. 6 in. beam, whereas the old boats are 63 ft. long with only 7 ft. 4 in. beam. The new boat, which has a lifting weight of 11½ tons, is steel built throughout, with a flush deck, and she has a mean draught of 2 ft. 3 in. The forward part is completely covered by a turtle-back designed to throw off the sea. Beneath this turtle-back is a small cabin in which about a dozen men can be accommodated. Aft of the cabin is a low conning tower where the steersman stands, and from which position the officer discharges the torpedo. The whole of the central portion of the boat is occupied, as usual, by the machinery. Aft of the stokehold and the engine-room is another small cabin which will accommodate a dozen more persons, and between it and the stern is the storeroom. The boat is propelled by triple-expansion engines driving a three-bladed screw propeller. The boilers are of the usual Yarrow type, with a copper fire-box and copper tubes. The furnaces are fitted with forced draught, and the working steam pressure is 150 lbs. per square inch. The boat is fitted with a partially balanced rudder. Her armament consists of a revolving torpedo gun, which is carried aft and so arranged as to fire over either side of the vessel at any angle it may be desired to train it to. The object here in view is that the torpedo shall be discharged at any angle while the boat is going at full speed, instead of direct ahead as in the old system, which involves the boat being brought almost to a state of rest in the face of the enemy and under the fire of his machine guns. The difficulty of hitting a rapidly moving object compared with one at rest, as demonstrated by recent experiments, points to the importance of keeping the boat at full speed. She will also carry a Nordenfelt two-barrel gun as used in the English service.

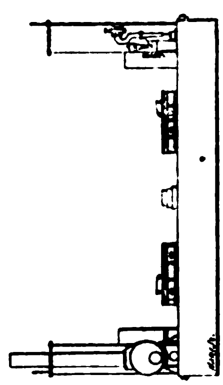
An Admiralty trial of the new craft took place on October 27th, the object being to carefully compare the present boat with the old boats. The trial was therefore made on exactly the same conditions as were formerly adopted, and consisted of a full-speed run of two hours' duration. The Admiralty was represented by Commander Egerton, Mr. Smale, and Mr. Shapcott, and the builders by Mr. Crohn. During the two hours' run six runs were made over the measured mile, three with and three against the tide, with the following results :—First run, 14·815 knots; second run, 19·251 knots; third run, 15·126 knots; fourth run, 19·780 knots; fifth run, 14·634 knots; sixth run, 18·274 knots. This gives an average speed of 17·147 knots, which was obtained with a mean of 507 revolutions per minute, and this speed was maintained throughout the two hours' run. The average speed of the old second-class boats was 16·5 knots. It will therefore be seen that, notwithstanding that the new boat is heavier, shorter, and broader than the old ones, there is actually an advance of speed of over half a knot. During the trial the manœuvring powers of the boat were tested and were found to be much superior to those of previous second-class boats. She turned the circle in 40 seconds, the diameter being 35 yards. There was an entire absence of heel when turning. Another noticeable point was freedom from vibration. During the trial the machinery worked in every respect to the satisfaction of the authorities.

THE WALLSEND PONTOON CO., LIMITED.

THE NEW PONTOON AT CARDIFF.

THE Wallsend Pontoon Company, Limited, opened their new Pontoon Dock at Cardiff, on Monday, the 13th ult., by dry docking, for painting and repairs, the screw steamer, *Dunholme*, belonging to Messrs. Watts, Ward & Co., of London, Cardiff, and Newport.





The Pontoon Dock is moored in the south-west corner of the New Roath Dock, in close proximity to the engineering works of the company. It lies well into the corner out of the way of shipping passing in and out of the dock, and as vessels can be docked on it irrespective of tides, a vessel may, if required, steam right on to it from Penarth roads, as we note that the Roath dock is usually on a level with the Roath basin at the top of high water.

The Pontoon lifted the *Dunholme* high and dry, ready for painting on Monday in 1½ hours; and a steamer might, if required, come in from the roads, go on the Pontoon, have her bottom sighted, and if found to be uninjured, be afloat again ready for loading in five hours time, and in the matter of painting, owing to the steamer being above the water level of the dock, it will dry rapidly, and give the paint every chance to be properly applied.

The Pontoon has been built completely by the Wallsend Pontoon Company, Limited, themselves, and it speaks well for Cardiff enterprise that such a large structure can be built here in such a short time as eight months, as is the case with this Pontoon.

The Pontoon is 320 ft. long, 70 ft. broad, and has two 12-inch centrifugal pumps, and one boiler on either side, giving it a lifting power of 3,000 tons, or in other words, it can dry dock a vessel with a deadweight capacity of 6,000 tons. Though this appears ample, the company have provided against the future (if steamers continue to increase in size), by having secured the right to increase the length of the Pontoon to 400 ft., and have also provided for such additions on the structure itself.

We may add that the Pontoon is constructed in six sections, each of which can be disconnected, and docked on the remaining portions of the Pontoon for painting and cleaning.

We made an inspection of the works of the company, which lie in close proximity to the dock, and they certainly appeared to us to be well laid out, and fitted with all the requisite appliances for dealing with all classes of repairs to steamers, as they are quite self contained in having shops for each branch of the business.

We were surprised to learn that the capital of the company is under £50,000, and the company is certainly to be congratulated on having got such an establishment with so many advantages, as regards position and appliances, on such a small capital.

We wish the Wallsend Company success in their new departure, and look forward to being invited by them some day to witness the launch of a large steamer built by them of steel made in their immediate neighbourhood in Cardiff.

THE Rotterdam Lloyd's Line of mail steamers between Rotterdam and Java have ordered a new steamer for their service of the following dimensions:—Length, 320 ft.; breadth, 36 ft. 9 in.; depth, 27 ft. The engines will be of 1,500 I.H.P., and of the quadruple-expansion type, having cylinders of 23 in., 33 in., 43 in., and 63 in.; length of stroke, 42 in. Steam of 200 lbs. working pressure will be supplied by two double-ended boilers, worked by a novel and simple method of forced draught; the air is to be supplied by two 6 ft. fans and heated by the waste products of combustion before entering the furnaces. The vessel will be named the *Bromo*, and is being built and engined by the Royal Shipbuilding and Engineering Company, Limited, de Schelde, of Flushing, Holland.

GREAT ECONOMIES IN THE CONSUMPTION OF COAL.

"THE Times" Barrow correspondent writes:—"An invention of the very highest importance to steam users has been patented by Messrs. Ashworth & Kneen, of Dalton-in-Furness, which, while bringing about an economy of something like 35 or 40 per cent. in the consumption of coal, also secures the total abolition of smoke. This new furnace, which has been experimented upon with the most rigid and searching tests, has been patented in Great Britain and 15 other countries. The patentees claim that the new furnace not only completes combustion but effects a saving in coal of at least 35 or 40 per cent. The most careful tests by Mr. D. K. Clarke, C.E., testing engineer to the National Smoke Abatement Institution, have demonstrated beyond the possibility of doubt that the new regenerative furnace will make more steam with a much smaller quantity of coal than is required to be used at present. It can readily be fitted to any boiler, marine included. Consequently it will be seen that the discovery is of the greatest importance to steam users. Further than this, the application of the new furnace to any boiler means the complete abatement of all smoke, a matter in which most of our large towns are deeply interested, as the smoke emitted from factory and other chimneys is felt and recognized to be not only a nuisance but a danger to health. Many scientific men, including some of the naval dockyard authorities, have inspected the new furnace, and speak of it in high terms. Hitherto, in the best designed boiler, even with careful manipulation of the fires, the waste usually amounts to one-half of the total of combustion of the coal. The Ashworth & Kneen furnace is specially designed to effect the rapid and complete intermixture of the combustible gases which pass from the ordinary furnaces with a supply of heated air, for the purpose of effecting their complete combustion with the entire prevention of smoke. Mr. D. K. Clarke says a high temperature is kept up behind the bridge by means of zigzag checker work, and oxygen from the atmosphere is conveyed without passing through the glowing carbon on the bars, and being robbed of its vitality and rendered useless for the purpose of combustion, in a thoroughly mixed and uniform condition to the gas when thus intensely hot, the result being perfect combustion, even in the case of ordinary or smoke coal. Mr. Clarke states that he witnessed a boiler having the Ashworth & Kneen patent fitted to it fed with ordinary slack, producing absolutely no smoke whatever, and that for a whole day, the evaporation during the same time attaining to 10·975 lbs., or practically 11 lbs. of water per pound of coal; while in the case of ordinary boilers, according to Mr. Sennett, a high authority in engineering circles, an evaporated duty from the best Welsh coal, which has considerably more heating power than ordinary North Country slack, usually amounts to something much less than nine or ten pounds of water per pound of coal, nine or ten being the *maximum* for the best Welsh coal. Mr. Clarke further states that by means of the Ashworth & Kneen system as much as 11·96 lbs., or practically 12 lbs. of water, was evaporated per pound of Newcastle coal. Messrs. Ashworth & Kneen can evidently give to our Navy the boon of smokeless funnels, an important matter, especially in time of war, without resorting to the use of Welsh coal, and, at the same time, a greater power for developing their engines. The air, which is heated to about 250 deg. Fahrenheit, is delivered into the hot-air chamber at the back of the bridge. Six days of systematic trials were made by Mr. Clarke, three with the patent system and three without it, elaborate care being taken to obtain correct results. It was remarkable that while less coal was consumed by the patent system, a much greater quantity of water was evaporated, a clear indication of increased heat, with a lessened consumption of coal. It was shown by these experiments that the ordinary furnace consumed as much as 23 per cent. more coal per hour than the patent furnace, which also evaporated 25 per cent. more water per hour; consequently 51 per cent. more water was evaporated per pound of coal by the patent system than by the ordinary furnace. The augmented evaporative efficiency corresponded to an economy of 34 per cent. of coal. This is a most important result for the consideration of steam users. When the air blast was shut off, the flue behind the partition was darkened with black smoke, which was speedily displaced by bright flames when the blast was restored. The products of combustion were found to be flameless and transparent, and the chimney top was perfectly clean."

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from October 24th to November 23rd, 1887.

Agnew, John Wm., engineer to the *Asia*, additional for charge of reserve stores, to date November 2nd.

Alexander, Isaac J., chief engineer to the *Wye* on promotion, to date October 23rd.

Allen, Henry J., assistant engineer to the *Monarch*, lent for training, to date November 7th.

Apps, Wm. R., assistant engineer to the *Volage*, to date November 22nd.

Banister, Charles, assistant engineer to the *Iron Duke*, lent for training, to date November 7th.

Bannatyne, fleet engineer to the *Asia*, additional, to date November 23rd.

Barker, Robert John, chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Basson, Harry, acting assistant engineer to the *Northumberland*, to date November 24th.

Bevan, Wm. J., engineer to the *Bloodhound*, to date November 2nd.

Bird, Samuel J., fleet engineer to the *Volage*, to date November 14th.

Bourke, Henry George, chief engineer, has been advanced to the rank of staff engineer in Her Majesty's fleet.

Broadbent, C., assistant engineer to the *Tyne*, to date December 6th.

Bromley, Wm., (a) engineer to the *Reindeer*, additional, for appointment when recommissioned, to date November 7th.

Brown, Walter, engineer to the *Swiftsure*, to date November 2nd.

Burner, W. H., chief engineer to the *Vernon*, to date November 1st.

Chope, Wm. D., assistant engineer to the *Dreadnought*, to date November 14th.

Cocks, Fredk. A., has been promoted to the rank of chief engineer, to date November 3rd.

Donohue, Robert W., assistant engineer to the *Vernon*, to date November 17th.

Edgar, Edward J., assistant engineer to the *Calypso*, to date November 2nd.

Fraser, Geo. John, chief engineer, has been appointed to the rank of staff engineer in Her Majesty's fleet.

Froud, Wm. S., assistant engineer to the *Iron Duke*, to date November 7th.

Gardner, John, chief engineer to the *Grasshopper*, to date October 5th.

Giles, William, fleet engineer to the *Minotaur*, to date Nov. 24th.

Glanville, Wm. Geo., assistant engineer to the *Alexandra*, additional, to date November 14th.

Grant, David, staff engineer, has been appointed to the rank of fleet engineer in Her Majesty's fleet.

Green, Donald F., acting assistant engineer to the *Agamemnon*, additional and for appointment, as additional when recommissioned, to date November 14th.

Green, Thos., engineer to the *Swift*, to date November 17th.

Haddy, Thos. J., engineer to the *Wanderer*, to date Nov. 17th.

Harding, George, chief engineer to the *Rapid*, to date Nov. 14th.

Harrison, Holland, staff engineer, has been advanced to the rank of fleet engineer in Her Majesty's fleet, on the Retired List.

Hastings, James F. A., assistant engineer to the *Dreadnought*, to date November 14th.

Hawkins, Frank W., engineer to the *Indus*, additional, to date November 4th.

Hender, William J., assistant engineer to the *Serpent*, to date October 24th.

Henwood, John W., engineer to the *Ready*, additional, and for appointment when recommissioned.

Hibbard, John A., assistant engineer to the *Orlando*, to date November 10th.

Hunter, Robert A., assistant engineer to the *Rover*, to date November 2nd.

Ireland, Joseph H. H., assistant engineer to the *Sultan*, lent for training, to date November 7th.

Jackson, T. P., assistant engineer to the *Northumberland*, to date November 5th.

James, Charles R., engineer to the *Neptune*, additional, for charge of reserve stores, to date November 2nd.

Keey, George E. M., fleet engineer to the *Iron Duke*, to date November 18th.

Kingsworth, A. F., assistant engineer to the *Northumberland*, to date November 24th.

Larg, James Collie, engineer, has been promoted to the rank of chief engineer in Her Majesty's fleet.
Laughton, Charles, assistant engineer to the *Belleisle*, to date November 5th.
Legate, James, fleet engineer to the *Dreadnought*, to date November 14th.
Little, Edwin, engineer to the *Canada*, to date October 28th.
Marous, Charles George, chief engineer, has been advanced to the rank of fleet engineer on the Retired List.
Martell, Percy D., assistant engineer to the *Monarch*, lent for training, to date November 7th.
Maudling, William J., chief engineer to Chatham Dockyard, to date September 29th.
Melrose, James, fleet engineer to the *President*, additional, to date November 23rd.
Moon, Henry J. G. G., chief engineer to the *Heroine*, to date October 4th.
Morton, William C., assistant engineer to the *Agincourt*, to date November 7th.
Mullinger, William J., engineer to the *Mistletoe*, to date November 11th.
Onyon, William, assistant engineer to the *Agamemnon*, additional, to date November 14th.
Parsons, William R., assistant engineer to the *Hercules*, to date November 5th.
Pascoe, George, assistant engineer to the *Dreadnought*, to date November 14th.
Ripper, John, engineer to the *Firebrand*, to date November 17th.
Roger, C. R., assistant engineer to the *Sultan*, to date November 7th.
Roye, Jas. A., assistant engineer to the *Agincourt*, lent for training, to date November 7th.
Ryder, John F., chief engineer to the *Thalia*, to date November 1st.
Silk, E. S., acting assistant engineer to the *Active*, to date November 2nd.
Simpson, Jas. M., assistant engineer to the *Agincourt*, lent for training, to date November 7th.
Smith, Alex. G., staff engineer to the *Constance*, to date November 17th.
Stevens, Wm. C., assistant engineer to the *Sultan*, lent for training, to date November 7th.
Stuart, M., assistant engineer to the *Dreadnought*, to date November 14th.
Thompson, J. H., acting assistant engineer to the *Northumberland*, to date November 24th.
Teed, Henry R., assistant engineer to the *Swiftsure*, to date November 2nd.
Walton, John H., staff engineer to the *Northumberland*, to date November 24th.
Watkins, B. J., assistant engineer to the *Northumberland*, to date November 24th.
Webster, Geo. P., assistant engineer to the *Myrmidon*, additional for disposal when recommissioned, to date November 10th.
Weeks, John C., fleet engineer to the *Northumberland*, to date November 24th.
Wells, Fredk. W., engineer to the *Dreadnought*, to date Nov. 14th.
Wiggins, Wm. Thos., acting engineer, has been confirmed in the rank of engineer in Her Majesty's fleet.
Williams, Thos., engineer to the *Kingfisher*, additional, and for appointment when recommissioned, to date November 7th.
Wootton, Wm. W., engineer to the *Handy*, to date October 28th.

The Cleveland Institution of Engineers.—The annual meeting of this Institution was held at Middlesbrough on Monday night, November 14th. The retiring president, Mr. Richard Howson, was unanimously re-elected, after which a paper "On the Effect of Dissociation on the Combustion of Fuel" was read by Mr. Edward Crowe, and resulted in a most instructive discussion.

Shipbuilding Contract.—Messrs. Wm. Simons & Co., Renfrew, have just contracted to build a fast steel screw steamer for passenger service on the Mediterranean. The vessel is to have saloon accommodation for 1st and 2nd class passengers, and electric-light is to be employed for lighting the various cabins, engine room, &c. The engines are to be of the triple expansion type, and will be made by the builders. A high rate of speed is expected.

SOUTH WALES TRADE NOTES.

Cardiff.—During the past month the trade at the Bute docks has been only moderate, the demand for steam and house coal has, for the time of the year, been inconsiderable. Orders have been fairly, but there has been a great lack of tonnage offering for employment. This, of course, is due to the demand from the Black Sea, and until the frost sets in in earnest very little improvement is expected. For steam coal prices are very firm; during the month special sorts were selling at from 9s. to 9s. 6d., good dry coal at 8s. 3d., and inferior descriptions at 7s. 9d. Small steam, however, has been exceptionally plentiful, quotations ranging from 3s. 3d. to 3s. 9d. Contrary to expectation, the advent of winter has had no material effect on the house coal trade, for although there has been a steady demand, the shipments have not been large enough to improve prices. Rhondda No. 3. towards the close of the month was at 8s. 3d., and 8s. 6d. was demanded in almost every case for forward delivery. The shipments of patent fuel from Cardiff have, on the whole, been fairly good; orders are coming in slowly but regularly, and during the past few days the tone of the market has been certainly improved; prices, however, remain unaltered. The Spanish iron ore trade has been very firm, and sellers refuse to do business for anything less than the market quotations. The latest quotations for Rubio ore were 12s. to 12s. 3d. c.i.f. Cardiff, or 12s. 4½d. Newport. Manufactured iron and steel.—The works of the district are all fairly well employed, but new orders have been coming in slowly. Steel rails were quoted on 'Change during the latter part of the month at £4 5s. to £4 7s. 6d. for heavy sections f.o.b., while light sections were selling at £4 17s. 6d. to £5 2s. 6d. f.o.b. Bessemer steel blooms were quoted at £4 5s., and bars £4 15s., less the usual percentage for cash. The pitwood market has been fairly firm throughout the month, the average quotations being 15s. 3d. to 15s. 6d. The outward steam trade market has been firm for almost every direction, but owing to the limited tonnage offering for employment, chartering has not been brisk. For higher Mediterranean ports there has been a good increase of tonnage, and rates have ruled very firm. For Italian ports orders have been coming in slowly, and, as a consequence, towards the close of the month rates, if anything, have a weakening tendency. Homeward rates from the Spanish ports have been firm throughout the month, and freights have still an upward tendency. In the sale market there has not been a great deal doing, but orders are now beginning to come in, more especially for the Brazils and River Plate, orders for these directions ruling very firm, as are also South American and Cape rates. The proposed removal of the Dowlais works to Cardiff has naturally excited considerable interest in the chief coal port of the principality. Already borings have been made on the moors, in order to test the depth of the gravel bed, and it is expected that as soon as the necessary details are completed the company will proceed to erect a couple of furnaces, and also mills. The furnaces will be constructed on the most approved modern plan, and will be able to turn out as much as any seven furnaces now at work at Dowlais. A rumour was freely current in the Hills last week that more than one iron industry contemplated removing to the seaboard, as it is generally felt in iron circles that few, if any, of the Welsh local manufacturers will be able, when the Cardiff works are erected and in full swing, to compete with them. This idea receives additional support, when it is borne in mind that a steel rail has a very long life, and the principal after buyers of this commodity will in all probability be, for some years to come, the Japanese, Chinese, and Burmese, and in this connection it is worthy of note that very recently the Japanese Port submitted Belgian and Welsh rails to a crucial test, with the result that the superiority of Welsh rails was proved to demonstration.

A Steamer Saved by her Tanks.—On Friday night, the 11th ult., the screw-steamer *Bakuin*, of London, while on her passage from Hamburg for Cardiff was run into off the Wash by the screw-steamer *Derwentwater*, of Newcastle, outward bound. The *Bakuin* received a tremendous blow on her starboard side aft, and her cabin and engine-room rapidly filled. It was reported at the time that her strongly-built bulkheads kept her afloat, and the ship was subsequently towed up to Penarth Roads, and placed in the Mount Stuart Dry Dock. On inspecting the vessel, however, we ascertained that she was one of the recently constructed steamers for carrying oil between the Russian port of Batoum and Hamburg, fitted with tanks. In her forward one she can carry 700 tons, and her after one 1,200. It was fortunate that the damage occurred where it did, just abaft the after tank, as it and the forward one gave her sufficient buoyancy to float her

up Channel, although her stern was almost under water. The ship throughout is very strongly constructed, and reflects great credit on her builders, Messrs. William Grey & Co., of West Hartlepool. The vessel was, we understand, planned by Mr. A. W. Doxford, Marine Architect, Sunderland, and Mr. J. Matthews, of London, personally superintended the building. The ship has been engined by the Messrs. Grey on the triple-expansion principle with an average speed of eleven knots. The repairs of the vessel are being effected under the personal supervision of Mr. J. Matthews, of London, and Mr. Joseph A. Seddon, of Cardiff.

The Wallsend Pontoon Company, Limited, did a smart piece of work with their new pontoon in the Roath Dock on Monday, the 21st ult. They docked the screw-steamer *Rovigo*, of Newcastle; the time occupied until she was high and dry ready for painting being only eighty minutes. By this means a vessel can be docked, sighted, and ready for loading in six hours.

Newport.—There is a difference in the tone of the tin-plate makers now and a few markets back. The former was devoid of the excitement and confusion of a backward period, and now tin-plate makers clearly perceive that they can maintain their own interests, despite the operations of the "tin corner" by combined action, and by such action, either force an advance in the price of the manufactured article, or as a protective measure, close their tin houses, and thus bring about a famine production. The following are the ruling quotations:—Steel: Bessemer steel bloom, £4 5s.; brass, £4 15s.; Siemens' bars, £5 2s. 6d. per ton. Welsh ports, less the usual percentage for cash. Steel sections, £4 5s. to £4 7s. 6d. f.o.b. Light colliery sections £5 to £5 2s. 6d. f.o.b. net. Tin plates: Coke tins, i.c. per box, 14s. to 14s. 3d. Bessemer steels, 14s. 3d. to 14s. 6d.; Siemen's, with coke finish, 14s. 6d. to 14s. 9d.; charcoal tins, 17s. 6d. to 20s., according to grades. Terns (28 by 20) i.c., 24s. 6d. to 28s. per double box. Welsh ports less the usual percentage for cash. Wasters, 6d. to 9d. per box less than primes. Iron: Merchant bars, £4 7s. 6d. to £4 10s. Angles, &c., at usual extras, f.o.b., maker's works. Pig iron: Glasgow transit market firm, buyer's prices fluctuating. Sellers, 39s. 1d. cash to 39s. 4d., one month. Hematite warrants: Makers are asking 42s. and 42s. 6d. cash for mixed numbers f.o.b. Cumberland Middlesborough No. 3, market steady. Swansea hematite Bessemer pig iron, £2 8s. 6d.; Cromavon best, £2 8s. 6d., f.o.b., at works, with the usual discount for cash. Pitwood, 15s. 5d. to 15s. 9d.; iron ore, 12s. to 12s. 3d.; steam coal (best), 7s. 9d. to 8s.; seconds, 7s. 3d. to 7s. 6d.; screenings, 4s. 3d. to 4s. 6d.: house coal, 9s. 3d. to 9s. 9d.; smiths' coal, 5s. 3d. to 5s. 9d. Freights are firm all round.

Swansea.—There appears to be no abatement of the excitement in the tin-plate trade. Tin-plate makers are evidently prepared to accept the present state of matters as regards block tin and to adopt either an advance in tin plates, or a stoppage of works. The former seems to be in favour, as the promoters of the "tin corner" have been so far able to hold their own. As regards raw materials there is a visible increase, and is in accord with the aggregate increase of the year, showing Swansea to be rising in this respect, and that the demand for tin plates is increasing in volume year by year as new markets are being opened up for domestic and other purposes. The power of production keeps well apace, if not in advance of it. Pig Iron.—There seems to be a better tone for this commodity, and for hematite pigs the market is firmer. Makers of steel rails and bars have plenty of orders to last over the winter months. Copper maintains its advanced value. Anthracite coal is well maintained in price, and is in good demand at present. Spelter is progressing, and likely to go up. Prices: block tin £141 to £142 cash; copper is still rising in value, Chili bars being now quoted at £48 12s. 6d. to £49 cash; and Spelter is strong at £17 2s. 6d.

New Russian Cruiser.—The completion of the new Russian armoured cruiser *Souvenir de l'Azov* is announced. It is said to be capable of steaming 20 miles an hour, or even more, and it can carry sufficient coal for a voyage of 20,000 miles without entering port. The armament consists of 16 8-centimetre guns, and it is also equipped with two torpedo boats. The crew numbers 500 sailors and 25 officers, and the first commander of the ship is to be Captain Lohmen, who was naval tutor to the Grand Duke George Alexandrovitch.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE improved state of affairs shown to have set in in Clyde shipbuilding and engineering industries during the month of October has happily continued throughout November. Indeed, within the past two weeks, many very important contracts have been booked, and inquiries are being made in connection with proposals to build steamers in such numbers and of such sizes as augurs exceedingly well for the immediate future of this important industry. Amongst the most noteworthy contracts are one booked by Messrs. R. Napier & Sons, Govan, for a steamer of about 6,000 tons for the Royal Mail Steam-packet Company, for trading between Southampton and the West Indies; one secured by Messrs. Barclay, Curle & Co. for a steamer of 3,600 tons for the West Indian and Pacific Steam Navigation Company, similar in every respect to the vessel ordered from the same firm about two months ago; and one for a screw steamer of about 4,000 tons for the British Indian Steam Navigation Company, by Messrs. A. & J. Inglis, Pointhouse. All the vessels in question will be fitted with the now universal triple-expansion type of engines.

Several other important contracts are pending settlement, amongst which is one for two twin-screw steamers of about 4,500 tons each, for a new company called the Anglo Scandinavian Steam Navigation Company. The engines for these vessels, on the triple-expansion principle, are to be of the best possible class of workmanship and material. Quite a number of Clyde firms are offering for the construction of hull and engines. Mr. Geo. Stephen, president of the Canadian Pacific Railway Company, is presently negotiating with Clyde builders for three large vessels, which, when constructed, will complete the Canadian Pacific's connection with the East from Vancouver. For some time back the company have had several chartered vessels sailing in connection with their train service, but with the view of further opening up and developing trade to and from our eastern colonies, these will be superseded by the three steamers in question.

Altogether something like 35,000 tons of new shipping have been contracted for since the beginning of November by Clyde builders, and seemingly almost as much again is presently in the market. It goes without saying that this augment to the work of shipbuilders implies corresponding briskness in the shops of engineers, boiler makers, and all the subsidiary branches of industry.

About the beginning of the month Messrs. Napier, Shanks and Bell, Yoker, received an order to build a large steamer for a Canadian firm for lake service. The firm's yard at Yoker has previously been vacant, and the construction of this ship gave employment to many men then idle. About the same time Messrs. Aitken & Mansel, Whiteinch, and Messrs. John & James Thomson, engineers, Finnieston, contracted to build and engine a new steamer of about 2,000 tons for the Atlas Steamship Company. The vessel is of the following dimensions:—Length, 290 ft.; breadth, 37 ft.; and depth, about 25 ft. The engines, which are to be of the triple-expansion type, will indicate upwards of 2,000 H.P., and as already stated, will be constructed by Messrs. Thomson. The vessel is to trade between New York and the West Indies, and will carry the mails between these places. Messrs. Aitken & Mansel are negotiating for the construction of a small steamer for East Indian trade, in addition to tendering for the Anglo-Scandinavian steamers already alluded to. Messrs. A. & J. Inglis, in addition to contracting with the British India Steam Navigation Company for the large vessel before alluded to, have just been entrusted with the re-engining of that company's screw steamer *Madura*. In addition to substituting triple-expansion engines for the compound engines by which she is at present propelled, Messrs. Inglis will subject her internal arrangements to a complete overhaul.

The Fairfield Shipbuilding & Engineering Co. Limited, have been instructed to build a steel paddle-steamer for the Isle of Man, Liverpool, and Manchester Steamship Company, Limited. The vessel is to be 260 ft. long, 33 ft. beam, and to have a speed of 19 knots, and is to be delivered in May, 1888, so as to be ready for the season's traffic between Fleetwood and the Isle of Man. The splendid steam yacht *Lady Torfrida*, 625 tons, belonging to Sir W. Pearce, Bart., M.P., of the above firm, has been sold to Mr. Bayard Brown, Florida, U.S. The yacht is now being fitted out at Fairfield for a nine months' cruise. It is also stated that

Sir William intends to build for himself at Fairfield another yacht of 800 tons, which, it is anticipated, will be a model for speed and luxurious comfort.

Messrs. William Simons & Co., Renfrew, have received an order to construct and engine a screw steel steamer, for passenger service on the Mediterranean. The vessel is to have saloon accommodation for first and second class passengers, and the electric light will be used for the lighting of cabins, engine-rooms, &c. The engines are to be of the triple-expansion surface condensing type, and it is expected the vessel will attain a high rate of speed.

Messrs. John McArthur & Co., Abbotswich, Paisley, have secured a contract to build for a firm in New Zealand a steel screw steamer, 172 ft. long, 26 ft. beam, 13 ft. 10 in. deep, with double bottom, and water ballast. She is intended for trading purposes at New Zealand, but will be provided with passenger accommodation for forty persons. Her engines will be of the triple-expansion type, to indicate about 850 H.P. For Mr. David McBrayne's West Coast of Scotland passenger traffic Messrs. McArthur & Co. have contracted to build a paddle steamer, the engines for which will be made by Messrs. Hutson & Corbett, Kelvinhaugh.

The splendid screw steamer *Jelunga*, which was built on "*spec*" by Messrs. W. Denny & Brothers, Dumbarton, has been chartered by the Compaina Transatlantica of Barcelona. This vessel, which was launched towards the end of August, is 410 ft. long, 48 ft. broad, and 32 ft. deep. She has large accommodation for first, second, and third class passengers, and has quadruple expansion engines, constructed by Messrs. Denny & Co., Dumbarton. Messrs. Denny & Brothers, in addition to the large paddle wheel steamship for the Ostend and Dover service mentioned in last month's notes, have arranged for the building of a first-class screw steamship of 3,300 tons gross measurement, which will be fitted with quadruple-expansion engines by Messrs. Denny & Co., on the principle patented by Mr. Walter Brock, and so successfully introduced into some recent steamers.

Messrs. Russell & Co., Port Glasgow, in addition to the four vessels mentioned in last month's notes, which they are now building, have contracted to build two large four-masted sailing ships of upwards of 2,000 tons each, one for a French firm, and the other for a Glasgow owner. They have also secured a contract for a steamer of 2,500 tons for an English firm. Messrs. John Reid & Co., Port Glasgow, have secured a contract for a steel barque of 1,200 tons. Messrs. D. J. Dunlop & Co., Inch Works, Port Glasgow, have received an order to supply the s.s. *Afton* with triple-expansion engines. The *Afton* was built some time ago by the Messrs. Dunlop, her engines being of the surface-condensing type.

Messrs. Scott & Co., Greenock, have just concluded a contract for the construction of a screw steamer of 2,000 tons for the Eastern trade. The engines for the vessel are to be of the triple-expansion type, and will be supplied by the same firm. Messrs. Scott & Co. have at present only one steamer on the stocks, and it is of considerably smaller dimensions than the one just booked. It is rumoured that other contracts have been secured by Greenock builders, but it has not yet been confirmed. Messrs. Caird and Co. have at present nothing on the stocks, and nothing has been done by them since the *Britannia*, the last P. & O. steamer, left their hands.

Rapid progress is being made with the buildings for the forthcoming International Exhibition, erected in the Kelvingrove Park, Glasgow. Since the beginning of the work of erection not a day has been lost, and a very adequate idea of the beauty which the design will show when fully completed is now obtained. The main buildings have now been almost entirely roofed in, and the glazier work almost completed. Eight of the tall towers, which form so striking a part of the design, have been completed, and the erection of the dome, the central feature of the building, is being rapidly proceeded with. The main girders for supporting the dome are all in position, and the workmen are now busy in getting the ribs into their places. The brickwork of two of the four octagonal towers flanking the dome is all but completed, and that of the others is well forward. A month, it is believed, will see the completion of this part of the undertaking, and the fabric of the Exhibition will then be practically finished. The construction of the machinery annexe, which occupies the ground to the west of the main building, was commenced about a month ago. Its brick walls and rows of iron columns for supporting the roof were quickly erected, and now all but the central avenue has been roofed in. The entire building, it is expected, will have been completed by the new year.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—The improvement in the freight market, which is the necessary preliminary to an improved demand for new tonnage, has now made itself felt in almost all trades, and the likelihood of its continuance is no longer doubted by even the most sceptical. In the shipyards, however, no very pronounced increase of work is yet to be noticed, and there is now little prospect of any appreciable change taking place until the days again begin to lengthen. Shipbuilders who have orders will not, unless pressed by owners, make much headway with them during the winter months, and as pressure for early delivery is now a matter of rare occurrence, it may be assumed that comparative dulness will continue to characterise the trade until the spring. Messrs. Armstrong, Mitchell & Co. are doing very little at their Elswick yard, the fitting out of the ironclad *Victoria* being the principal work in hand. At their Low Walker yard, considerable quietude also exists, but frame turning has been again resumed, and there is a probability that another period of briskness is about to be entered upon. Messrs. Stephenson are briskly pushing forward their works of improvement in connection with their Hebburn yard. The large 100-ton shear legs, which have been some months in course of construction, are now ready for lifting into position on the new jetty, and the erection of new boiler and fitting shops is being proceeded with as rapidly as possible. Messrs. Hawthorn & Leslie have ready for launching the second of two splendid steamers which were ordered from them early in the year by Messrs. Milburn & Co., Newcastle. They have also in advanced stages two fast passenger steamers that are intended for the China trade. Great briskness still exists in the yard, but frame turning has been temporarily suspended, and this circumstance is likely to adversely affect the outside departments ere long. Messrs. W. Richardson & Co. have launched two vessels during the month, one of them being a specially ordered boat of somewhat peculiar construction, which is intended for the Indian coasting trade. Messrs. Dobson & Co. launched the second of the Russian steamers, which have been referred to in greater detail in previous reports, and they have laid the keel for a vessel of more than the average dimensions. Messrs. Schlesinger & Davis and Messrs. Readhead have each launched a vessel during the month, and it is understood that Messrs. Edwards have disposed of one that had lain on their hands some time. The Tyne Shipbuilding Company have sold a vessel which has been the sole occupant of their stocks for some months past, and they have secured an order for another, the construction of which will shortly be commenced. In the repairing establishments, there is at present comparatively little doing. In the marine engineering trade the state of business is decidedly satisfactory, as the orders obtained in respect of engining new vessels are being supplemented by contracts for repairs and renewals, and as a consequence the resources of several leading firms are being fully utilized. The minor branches of the engineering industry are also greatly improved, and many of the firms engaged in the manufacture of steam winches, steam steering gears, &c., are well supplied with orders for their specialities. Messrs. Emerson, Walker, & Thompson Brothers, are keeping all their departments in operation, and Messrs. Clark, Chapman & Parsons, are busier than they were in the early part of the year. Messrs. Carrick & Wardale, are busy on orders for their well-known steam feed, bilge, and ballast pumps, and the specialities of Messrs. Donkin & Nichol appear to be in great request by steamship owners at all the leading ports. The torpedo boat recently engined by Messrs. E. Scott & Co., has had a satisfactory trial. Steel works at Newburn, Consett, and Jarrow are in full swing, but the iron works of the district are either wholly inoperative or are only working intermittently and on a small scale. H.M. Indian Government have just favoured Mr. Wasteneys Smith, of Newcastle, with another order for several of his patent "stockless" anchors.

The Wear.—The improvement in the Wear shipbuilding trade, spoken of in last month's report as beginning to manifest itself, is now more distinctly seen. Messrs. J. L. Thompson and Sons, frame turners, are working night and day, and the frames for two large vessels are being turned off simultaneously. Four keels have been put down in the yard, and the blocks for a fifth have been laid. The firm have also a vessel nearly ready for launching. The Strand Shipbuilding Company have just disposed of a vessel that has stood on the stocks for over five years. The vessel is being altered with a view to increasing the carrying capacity, and will be launched early in December. Messrs.

Bartram & Haswell have commenced frame turning for a large vessel ordered by the Nautilus Steam Shipping Company, and the Sunderland Shipbuilding Company have laid the keel blocks, and ordered the frame material for a vessel to be 310 ft. long, which they are going to build on the speculative principle. It was stated in last month's report that Mr. Laing had put down a large vessel on his own account. This has since been sold, and the construction of two others has been commenced. There is also a vessel in the preparatory stage. Messrs. Short Brothers have been engaged during the greater part of the month in extensively repairing the s.s. *German Emperor*, owned by Mr. J. S. Barwick. This vessel has been supplied with Henderson's self-cleaning furnaces by Messrs. Readhead & Ingram, the Sunderland agents. It may be mentioned in passing that the s.s. *Inflexible*, belonging to Messrs. Horan & Anderson, is also to be supplied with these appliances, and that the whole fleet, under the management of Mr. James Westoll—30 vessels in all—are to be similarly dealt with. Messrs. Doxford are preparing to launch the only vessel on their stocks, and it is understood that the initiatory stage of another has been commenced. Messrs. R. Thompson & Sons are finishing a very fine vessel, which has been on the stocks for an unusually long period. The firm have repaired several steamers during the month. In connection with the engineering trade, the most important incident which has occurred during the month was the sale by auction of the large, newly-erected engine works belonging to Messrs. Carr & Company. The works were purchased on behalf of some local gentlemen, and as they are in perfect order, it may be anticipated that they will soon be put in operation. At the four principal engineering establishments business is either very active or tending in that direction. Messrs. C. & M. Douglas, of the Low Quay and Bedford-street Engine Works, are now engaged in manufacturing two recently patented articles, namely, "Child's Single Band Return Telegraph," and "Sellar's Boiler Filter." Both are for use in steamships, and on account of the advantages claimed for them, are expected to attain a wide popularity. Mr. A. A. Rickaby, of the Bloomfield-street Engine Works, has this month received large orders for his patent piston rod packing and other specialities, and Messrs. John Lynn & Co., of the Pallion Engine Works, have so much work in hand (principally steam winches for Tyne and Wear shipbuilders) that they contemplate putting down more machinery. Messrs. Irving & Jopling turned out from their works this month a carefully finished boiler of the Lancashire type, for use in a local flour mill. It is understood to be the largest of the type mentioned that has ever been constructed in the district. Messrs. Ridealgh & Fairman are receiving as many orders as they can possibly deal with for their "Silent Gas Engine," and a large extension of their productive resources is contemplated. The large forge recently opened by Messrs. J. L. Thompson & Sons, at Pallion, is being furnished with every requisite for rapid and economical production, and when all the arrangements are completed, there will be few places in the Northern Counties to surpass it in point of special adaptiveness to the manufacture of heavy forgings for shipbuilding and engineering works.

The Hartlepools.—Messrs. W. Gray & Co. launched on the 19th inst. a vessel of exceptionally large dimensions, which was built to the order of local owners. The firm have a large amount of work in hand, and excellent winter prospects. Messrs. Withey are also in a position to keep their fine array of machinery in full operation, and in this case, as well as in the other, the future outlook is satisfactory. There is no abatement of activity in the marine engineering establishments, and many enquiries are coming to hand.

The Tees.—Since last month no important changes have taken place in the condition of work in the shipbuilding establishments of the Tees. Marine engineering works are still busy, but ironfounders are generally complaining of diminished orders. Steel manufacturers have as many contracts as they can deal with, and in the finished iron trade there is a decided tendency towards improvement.

A Fast Passage.—The Orient Line steamer *Ormuz*, which left Suez on October 27th with the mails of October 21st, arrived at King George's Sound on Monday evening, November 14th, and landed the mails and passengers in less than twenty-four days from London. The steamer maintained throughout an average speed of upwards of 15½ knots, which is considerably in advance of the best speed ever before attained on the Australian voyage.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

J. W. Taylor.—On October 19th Messrs. Short Brothers launched from their yard at Pallion, Sunderland, a screw steamer built to the order of Messrs. Taylor & Sanderson, of Sunderland. Her principal dimensions are:—Length, 315 ft.; breadth, 40 ft.; depth of hold, 28½ ft. The vessel is constructed entirely of steel, and to the highest class at Lloyd's, under special survey, as a spar-deck steamer, with cellular double bottom all fore and aft, divided into separate compartments for trimming. There are six water-tight bulkheads dividing the vessel into four separate cargo holds, with large hatchway and steam winch at each, and there is a large multitubular steel donkey boiler on deck to supply winches with steam. The vessel is also fitted with direct steam windlass, steam steering gear, &c., and all the latest improvements. On leaving the ways, the vessel was named the *J. W. Taylor* by Mrs. W. P. Baker, of Sunderland. The vessel is to be fitted with tri-compound engines of 1,320 H.P. by Mr. John Dickinson, of Sunderland, and will be commanded by Captain Cook.

Aurora.—On October 28th the *Aurora*, twin-screw steel cruiser, was launched from Pembroke Dockyard. She was designed in 1884 by the Admiralty Board of Construction, and her construction was commenced in February, 1886. Her principal dimensions are as follows:—Length, 300 ft.; breadth, 56 ft.; weight when launched, 2,600 tons; and when fully equipped, 5,600 tons, and her armour belting is of compressed armour, 10 in. thick. She will be propelled by engines of 8,500 H.P. (with forced draught), which are being made by Messrs. J. & G. Thomson & Co., Glasgow.

Amphitrite.—On November 2nd Messrs. Edward Withy & Co. launched from their yard, at Hartlepool, the steel screw steamer *Amphitrite*, built to the order of Messrs. Rickinson, Son & Co., West Hartlepool. She is a splendid vessel, of 300 ft. in length, with a large deadweight and measurement carrying capacity, and built to the 100 A1 class at Lloyd's. The vessel has a long raised quarterdeck, short poop, long bridge house, and a topgallant forecastle. The main, bridge, quarter and forecastle decks, and five watertight bulkheads are of steel; the charthouse, cabin skylight, engine-room skylight, bulwark rails, galley and cargo battens are of iron. The steamer is built on the web frame system, and fitted with Withy and Sevewright's patent improved cellular double bottom for water ballast, all fore and aft; four steam winches, patent windlass, three stockless anchors hauling up into hawsepipes, two donkey boilers, hand and steam steering gear amidships, and right and left hand screw gear aft. The vessel is rigged as a two-masted fore and aft schooner, with iron lower masts, and will be fitted with triple-expansion engines by the Central Marine Engineering Company, of West Hartlepool. On leaving the ways, the vessel was gracefully christened *Amphitrite*, by Miss Leybourne, of West Hartlepool.

Oakwell.—On November 8th Messrs. Craig, Taylor & Co. launched from their yard the s.s. *Oakwell*. She is 125 ft. by 22 ft. by 11 ft. 1 in., built for the coasting trade and fitted with large hatches and powerful winches. Engines are being fitted by Messrs. Westgarth, English & Co. of Middlesbro', and are 50 N.H.P., having cylinders 18 in. and 36 in. by 24 in. with a large steel boiler for 85 lbs. working pressure.

Dora.—On November 14th Messrs. Thomas Turnbull & Son, launched from their premises, Whitehall, Whitby, a screw steamer built of steel. The vessel was christened *Dora*, by Miss Dora Hayes. The dimensions of the vessel are:—Length, 310 ft. 9 in.; breadth, 38 ft.; depth, 25 ft. 7 in. She is classed A1 at Lloyd's, and is estimated to carry about 3,600 tons. Her engines are by Messrs. Blair & Co., Stockton, and are of 180 N.H.P., and she is fitted with Emerson, Walker & Thompson Bros. patent steam windlass.

Hindoo.—On November 14th the *Hindoo*, a clipper steamer was launched from the shipyard of Messrs. Wigham Richardson and Co., at Low Walker, and was at once towed under the shears to receive her engines, which are of 1,500 H.P., and of the builders' own make. The *Hindoo* was named by Miss Christie, of Tynemouth, and will proceed to Bombay as soon as ready, where she will be employed exclusively in the passenger traffic upon the coast. She has been built under the superintendence of Messrs. W. & C. Thompson, of Fenchurch Street, London.

Platon.—On November 15th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., at Bill Quay, a steel screw steamer, built to the order of the Russian Company for Transport and Insurance. Her principal dimensions are:—220 ft. by 30 ft. by 20 ft. to awning deck, and she has been built under Lloyd's special survey, and will be classed 100 A1. The engines are by the North-Eastern Marine Company (Limited), Wallsend, built on the triple-expansion system, and of 650 I.H.P., to propel the vessel loaded 10½ knots. The vessel, which was named the *Platon*, has been specially designed for the coasting trade of the Black Sea, and is a sister ship to the *Nicolas*, now on the stocks in the yard of Messrs. Wood, Skinner & Co., and which will be launched in about a month. As the vessel left the ways she was christened by Madame Safonoy, and was immediately afterwards towed away to Wallsend to receive her machinery. Captain Safonoy has represented the Company in England during the construction of these vessels, and Mr. Loupanoff has inspected the machinery.

Asama.—On November 16 Messrs. M. Pearse & Co. launched from their building yard at Stockton-on-Tees a steel screw steamer, 370 ft. long, classed 100 A 1 at Lloyd's, built off the three-decked rule, and specially arranged for the Indian trade. She will be engined by Messrs. Blair & Co. (Limited), and will be fitted with a powerful direct steam windlass, Emerson, Walker & Co.'s patent. As she left the ways she was named *Asama*, by Miss Pearse.

Locksley Hall.—On November 16th there was launched at Jarrow, from the shipbuilding yard of Messrs. Palmer & Company, Limited, a steel screw passenger steamer of the following description, namely:—Length between perpendiculars, 380 ft.; breadth, moulded, 45 ft.; depth, 30 ft. 3 in.; depth of hold, 27 ft. 6 in. The vessel has been built of special strength beyond what is required by Lloyd's for the three deck class, with cellular double bottom throughout. She is fitted with a long promenade deck amidships, with accommodation under for 60 first-class passengers, captain, officers, and engineers, and large dining saloon at the fore, and extending the full width of the ship. A large teak deck house will be placed on the promenade deck enclosing the saloon entrance, ladies' room, commodious smoke room, and chart house. A long poop is fitted with accommodation for second-class passengers at fore end, and crew at aft end; topgallant forecastle, with steam windlass under, and double warping capstan on top, supplied by the firm of Messrs. Clarke, Chapman, Parsons & Co. The vessel will be fitted throughout with the electric light, and all the latest appliances for rapidly discharging cargo, and is also fitted with Harrison's steam-steering engines. The vessel will carry 6,700 tons of deadweight on a moderate draught. The vessel will be propelled by a set of triple-expansion engines, also constructed by Messrs. Palmer's company. They will have cylinders 29 in., 47 in., and 76 in. diameter, with a stroke of 51 in. Steam will be supplied by two extra large double-ended boilers, constructed of steel for a working pressure of 150 lbs. per square inch. The machinery will be fitted with the most recent improvements in the shape of steam reversing gear, and other fittings necessary for convenient working. The vessel will be supplied with six powerful winches and a large donkey boiler for driving these and other auxiliary engines. The ship has been built under the personal superintendence of Mr. Henry West and Captain M. H. Foster, and the engines under Messrs. Goodwin and Hamilton. The vessel on leaving the ways was christened the *Locksley Hall* by Mrs. William Denton, wife of the assistant-general manager of Palmer's Company.

Montana.—On November 16th Messrs. W. Gray & Co. launched a fine steel screw steamer, 330 ft. long, 41 ft. wide, and 28 ft. 6 in. deep; built to the order of B. N. Baker, Esq., President of the Atlantic Transport Company of Baltimore and London, to take Lloyd's highest class and carry over 4,200 tons deadweight on the Atlantic trade. This vessel is very strong, having two complete iron decks, protected with sheathing, and a tier of beams in the holds suitable for a third deck, while the large full poop, bridge, and forecastle, joined by a shelter deck for cattle, make her for practical purposes a four decker. The bottom is constructed on an improved cellular double bottom principle and is very strong. Six watertight bulkheads are fitted, and a permanent iron fore and aft bulkhead in the holds to prevent shifting of cargo. Two strakes of shell plating at the bilge and topsides are doubled above Lloyd's requirements, and in addition to a deep bar keel, bilge keels are fitted. Three pole masts will be fitted, with yards on the fore-mast and a smart rig. Four hatches, with a powerful steam winch at each, having connection to work the bilge pumps, a steam windlass on the forecastle, steam steering gear in house amidships and screw steering gear aft, a multitubular donkey boiler, two distillers to supply 8,000 gallons of fresh water per day into large cattle tanks and to overflow into fore peak tank, a special donkey pump being provided to circulate the water. The captain's and officers' cabins are fitted in the poop with saloon, &c. The engineers' rooms are under the bridge, and the crew in the topgallant forecastle. The rooms are all heated by steam, arrangements of the most approved kind are made for conveying about 500 cattle, and over thirty large ventilators are fitted to insure a good supply of fresh air to every part. Side coaling and cargo ports are fitted and everything is provided which can contribute to the safety and efficiency of the vessel. The engines are on the three-cylinder triple-expansion principle, and will indicate about 1,600 H.P. They are constructed by the Central Marine Engineering Company, West Hartlepool. The speed of the ship will be about 11½ knots per hour. During construction the vessel has been superintended by Mr. Frederick Murrell and Captain W. H. Williams, while the machinery has been under the superintendence of Mr. A. E. Allen of Hull. The christening ceremony was gracefully performed by Mrs. Williams, wife of Captain Williams, and the vessel named *Montana*. The *Montana* will be the latest addition to the fine fleet of transatlantic cargo and cattle carrying boats owned by the Atlantic Transport Company. The other vessels of the line, the *Surrey*, *Maryland*, and *Swansea*, have all been built by William Gray & Co., and have established a well earned reputation for the speed and regularity of their passages and for the safety with which large numbers of cattle have been conveyed by them.

Elton.—On November 19th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—310ft. by 38 ft. 6 in. by 23 ft. 3 in. moulded; to carry 3,750 tons; built to the order of Messrs. R. Ropner & Co., of West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing saloon and cabins for officers and a few passengers; long raised quarter-deck, long bridge of extra strength right up to fore-hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward, with Emmerson, Walker & Co.'s windlass to work Parkes' patent stockless anchors stowing into hawsepipes without the use of the usual crane, cat, and fish tackling. The hull is built on the web frame principle, dispensing with hold beams and giving a clear hold for working cargo. Five hatches are fitted with four steam winches, steam steering gear, two donkey boilers, and water ballast in double bottom under each hold. The vessel will, in every respect, be well equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. Blair and Co., Limited, Stockton-on-Tees. During construction, the vessel has been superintended by Capt. C. B. Rooke. The christening ceremony was gracefully performed by Miss Lilian Ropner, daughter of the owner, the vessel being named *Elton*. It may be added that the *Elton* is the seventeenth vessel Messrs. W. Gray & Co. have launched for Messrs. R. Ropner & Co.'s fine fleet of steamers.

Saxon.—On November 19th the Union Company's steamer *Saxon*, which is destined for work on the South African coast in connection with the Royal mail steamers between England and the Cape, was launched from the yard of Messrs. Oswald Mordaunt & Co., Woolston, Southampton, by whom she was constructed. She is classed 100 A 1 at Lloyd's, and her dimensions are:—Length, 145 ft. 6 in.; breadth, 24 ft. 6 in.; depth, 16 ft. 8 in., and she will have accommodation for 47 passengers, 17 first-class, and 30 second-class. She has four watertight bulkheads, steam steering gear, water ballast, and all modern improvements. Her engines, which have also been constructed by Messrs. Mordaunt & Co., are of the triple-expansion type with cylinders of 14 in., 23 in. and 38 in. diameter; length of stroke, 27 in. She has a heating surface of 1,200 square feet, and boiler power capable of working up to a pressure of 160 lbs. to the square inch. It is expected that the *Saxon* will develop a speed when fully loaded of 10½ knots per hour at the measured mile. Owing to her light draught she will be able to enter many of the shallower harbours on the South African coast hitherto undeveloped, particularly that of the Knysna, with which port she will maintain regular communication in connection with the Ocean Mail steamers from England. The *Saxon* will be despatched to South Africa in the course of a few weeks.

Sorre-del-Oro.—Messrs. Craig, Taylor & Co. have lately launched a screw passenger steamer for Messrs. Segovia Cuadra, of Seville, built to the order of Messrs. Stephenson, Clarke & Co. Her dimensions are:—240 ft. by 32 ft. by 18 ft., with long full poop and T.G.F. She is handsomely fitted for both first and second-class passengers, and has the electric light fitted throughout in the passenger accommodation, and also for discharging cargo. Her engines are of the triple-expansion system; cylinders, 18½ in., 29 in., and 48 in.; stroke, 36 in.; pressure of steam, 160 lbs. Built by Messrs. Westgarth, English & Co., Middlesbrough. She is fitted with steam steering gear by Davis & Co., London, the windlass by Emmerson, Walker & Co., and three steam winches and large steam crane by Roger & Co. The vessel was gracefully christened *Sorre-del-Oro* by Mrs. Candlish, of Edinburgh. In consequence of the breakdown of the shear legs at Middlesbrough she is compelled to go to Hartlepool to ship her engines. The vessel has been built to the highest class, Bureau Veritas, and has been superintended by Mr. Cuthbert Potts, of Sunderland.

LAUNCHES.—Scotch.

Karagola.—On October 28th Messrs. A. & J. Inglis launched from their shipbuilding yard at Pointhouse, a steel screw steamer, of 1,200 tons, for the Indian coasting and mail service of the British India Steam Navigation Company. Her principal dimensions are:—Length, 240 ft.; breadth, 34 ft.; depth to main deck, 19 ft.; and to shade deck, 26 ft. 6 in. Passenger accommodation has been provided for 22 first and 16 second class passengers, while the main and 'tween decks have been arranged for the carrying of native passengers. Immediately after the launch the vessel was berthed under the shearlegs at the builders' wharf, where they at once commenced fitting the engines (of 1,800 H.P.) on board. The engines are of the t iple-expansion type, working at a pressure of 160 lbs. On leaving the ways the vessel was named the *Karagola*.

Sappho.—On October 29th Messrs. Scott & Co., shipbuilders, Greenock, launched from their yard at Cartsdyke an iron screw steamer of 550 tons register named the *Sappho*, built to the order of Mr. Alfred Holt, shipowner, Liverpool, and intended for the coasting trade in the East. Her dimensions are:—Length, 190 ft.; breadth, 30 ft. 6 in., and depth, from awning deck, 20 ft. She will be supplied by the builders with engines on the compound principle. She is sister ship to the *Hebe*, built for the same owners by Messrs. Scott & Co., in 1885.

Damascus.—On October 31st Messrs. R. Napier & Sons launched from their shipbuilding yard at Govan, a steel screw steamer of about 3,600 tons, which they have built to the order of Messrs. George Thompson & Co., of Aberdeen and London, for their China and Australian trade. The vessel is named the *Damascus*, and is a sister ship to the *Aberdeen* and *Australasian*. The *Damascus* is intended to attain a speed of about 13 knots at sea. The engines are fitted with three cylinders, which expand the steam from a working pressure of 150 lbs., and will indicate about 3,000 H.P. The steam is supplied by two double-ended steel boilers, fitted with corrugated furnaces. Her dimensions are 350 ft. in length, by 44 ft. in breadth, by 33 ft. in depth. The hull and machinery have been built under special survey to Lloyd's highest class, and all the most recent improvements have been introduced for the efficient working of the steamer and the rapid handling of the cargo. Accommodation has been fitted aft for 50 first-class passengers, and the officers' quarters amidships have had the special consideration of the owners, and are exceptionally well suited for service in a hot climate. The vessel was named by Miss Mary Henderson.

Glanmire.—On November 2nd there was launched from the Caledon Shipyard (Messrs. W. B. Thompson & Co., Limited), Dundee, an iron screw steamer of about 1,150 tons, named the *Glanmire*, the latest addition to the fleet of the City of Cork Steam Packet Company, Limited. Her principal dimensions are: —Length, 252 ft.; breadth, 33 ft; depth in hold, 15 ft. 3 in. She is built to the highest class at Lloyd's, and has a cellular double bottom throughout, capable of containing about 200 tons water ballast, which can be used to bring the vessel to any desired trim. The *Glanmire* is a somewhat different type of vessel from the company's other steamers, and has been designed with a view to be employed in all the company's routes as occasion may demand. She has accommodation for cabin and deck passengers, soldiers, sheep, horses, and cattle, the fittings for the live stock being all removable, so that cargo can be carried in their room when required. She has six water-tight divisions, three cargo holds, four steam cranes, steam winch, steering gear, and patent windlass by Emerson, Walker & Co., of the horizontal direct-acting type, all of the most improved description, and, besides the main engines and boilers, has quite a number of supplementary motors in the engine-room for providing power for pumps, donkeys, dynamo, &c. She is rigged as a fore-and-aft schooner, having two masts of steel, and presents the appearance of a flush-decked vessel, as her bulwarks are the full height of the poop bridge and forecastle decks. In the main cabin accommodation is provided for a large number of first-class passengers. From the poop to the forecastle deck the whole of the main deck is devoted to cattle and horse stalls, except a space before the boiler casing, where the engineers' rooms are situated. Under the forecastle deck rooms are provided for the officers and steerage passengers. A stair leading up to the forecastle deck and down to the barrack room is found here, the latter apartment being fitted up on the 'tween decks for the conveyance of soldiers. Three of the main deck hatchways are fitted with inclined gangways leading down to the 'tween decks and holds, which are provided with cattle stalls similar in design to those on the main deck. The engines (constructed at Messrs. Thompson's Tay Foundry, Dundee) are of the triple-expansion three-crank type, having cylinders 23 in., 38 in., and 62 in. respectively, with a piston stroke of 48 in., each engine working on a separate crank. The low-pressure and intermediate cylinders are fitted with ordinary slide valves, the high-pressure having a piston valve, and all three valves are arranged for a variable cut-off. A separate circulating pump, wrought by Drysdale's centrifugal pump and engine combined, is provided for circulating the water through the condenser. Steam is supplied by two multitubular boilers constructed of steel to Board of Trade and Lloyd's requirements for a working pressure of 150 lbs. on the square inch. Each boiler has three furnaces fitted with patent corrugated flues. The mountings include Cockburn's patent safety valve and stop valve combined. The first application of forced draught in Dundee has been made in connection with this vessel. The air is forced into the furnaces above and below the fires at a pressure of about three inches of water, the motive power being supplied by a fan placed in the engine-room, driven by an engine of about 10 H.P., the consequent gain in power due to the application of the forced draught being estimated to indicate 300 H.P. Like other first-class passenger steamers, the *Glanmire* will be fitted throughout with the incandescent system of electric lighting. There will be about 75 lamps of 16-candle power, and eight of 50-candle power, arranged in five circuits—viz., saloon, fore cabin, forehold, afterhold, and engine-room. For the loading and discharge of cargo a deck cluster of 50-candle power lamps will be erected over each of the four hatchways, and the holds will be lighted with fixed lamps. The gangways are also provided with portable lamps for the convenience of passengers embarking or leaving the ship. The launching ceremony was performed by Mrs. James Rae, wife of the Board of Trade Surveyor at Dundee. The vessel was towed to the Victoria Dock, where she will receive her masts and machinery.

Manwyne.—On November 7th Messrs. William Denny and Brothers, Leven Shipyard, Dumbarton, launched the *Manwyne*, a steel-built paddle-wheel steamer of 674 tons. She has been constructed to the order of the Irrawaddy Flotilla Company, Limited, and is being fitted with compound surface-condensing engines of 1,500 horse-power effective, by Messrs. Denny & Co., of the same town.

St. George.—On November 14th, Messrs. William Simons and Co. launched at Renfrew, another of their patent hopper dredgers with its machinery on board complete. The vessel, which is named the *St. George*, has a hopper capacity of 300 tons, and is constructed with Brown's improved form of bow and bucket ladder, an arrangement which adds considerably to the strength of the vessel, and by which it is enabled to dredge through banks and shoals to 30 ft. depth of water. The buckets are of steel, capable of loading the vessel in about one hour; powerful triple barrel mooring crabs are fitted at bow and stern, also ladder hoist, all driven by steam, for manœuvring speedily. Hopper crabs are fitted to open and close the hopper doors quickly. The propelling and dredging engines are of compound surface condensing type, and steam is supplied by a steel boiler, which is constructed for 90 lbs. working pressure per square inch. Friction gear is provided between the main engines and the dredging machinery.

Aqua-aerial.—On November 15th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, a unique specimen of naval architecture in the shape of a steel

twin-screw vessel, which is an entirely new departure from the recognized rules which govern the form and dimensions of ships of the present day. Mr. Dickie, the resident secretary of the Sun Life Assurance Society in Glasgow, has long conceived the idea of a vessel which, from its form, should be driven through, or rather over, the water at a high rate of speed, with a much smaller power in proportion to the resistance met than obtains in steamships of the present day, and the experimental vessel just launched from Mr. Cumming's yard is a practical embodiment of Mr. Dickie's ideas in this respect, as her name, the *Aqua-aerial* implies. The bottom of the vessel is perfectly flat, and consists of a series of inclined planes rising up forward with a long sweep to the bow of the vessel. The sides of the vessel, which are also perfectly flat, with a slight tumble-home, are carried below the bottom of the vessel, being then curved upwards and attached to the bottom plating, forming two broad hollow keels on each side, and these, along with a middle line keel of triangular form constructed of steel plates, divide the bottom of the vessel longitudinally into two parts. At the breaks formed by the meeting of the inclines, double transverse bulkheads are fitted with blow down flaps on top, and allowing of a supply of air being admitted under the bottom. The full breadth of the vessel is carried right forward and aft, the bow rising up and overhanging the water, the stern being exactly the reverse of this, the intention being to prevent eddy making there. A balanced rudder projecting beneath the bottom is fitted for steering purposes. The engines which are being fitted in the vessel will indicate about 60 H.P., and are of the triple-expansion surface-condensing type, with piston valves, capable of working up to 600 revolutions per minute, at a working pressure of 135 lbs. per square inch, and combining all the most modern improvements. To reduce the weights as much as possible steel and gun-metal are mostly used in their construction. The cylinders are supported on a light steel framing, the condenser is constructed of sheet copper, while the shafting and propellers are of phosphor bronze. As the shafting is carried underneath the bottom of the vessel, supported therefrom by brackets, the engines are placed in the bow, abreast of one another, to reduce as much as possible the inclination of the shafting which necessarily follows, and the propellers have the advantage of working entirely in unbroken water at the stern. The engines are by Mr. J. L. Napier, Glasgow. In the matter of boilers, also, the *Aqua-aerial* is unique, two of Mr. Neil's patent coil boilers being provided for the generation of steam, the coals which are also generally used for this purpose giving place in the present instance to petroleum, which is carried in a large tank fitted in the vessel. The boilers are placed athwartships in the middle of the vessel, and are each covered over with a light polished brass casing, with brass funnels. In general, the vessel is fitted throughout in a neat and tasteful manner, with cockpit forward and aft, with seats, lockers, &c., the floors being covered with linoleum. All woodwork is of teak, and all deck fittings galvanized. A short time will suffice to complete the vessel, after which it is intended to take her down the Clyde, where she will enter upon a series of experimental trials. The advantage which this peculiar form of vessel is expected to show is caused by the action of the inclined planes, which, when the vessel is being driven ahead, tends to raise her to the surface of the water, while the volume of air pouring down between the double transverse bulkheads, mixes with and breaks up the water, causing thereby a considerable diminution of the skin resistance to which the vessel is exposed, and under the combined action of these two influences a high rate of speed, with comparatively a small expenditure of power, is expected to be attained.

Devawongse.—On November 15th there was launched by the Fairfield Shipbuilding & Engineering Company, Limited, from their yard at Govan, a steel screw steamer of about 1,650 tons gross, for the Scottish Oriental Steamship Company, Limited, for their service on the China coast. The dimensions of the steamer are as follows:—Length 270 ft.; breadth, 36·9 ft.; depth 22·9 ft. The steamer has a straight stem and elliptic stern, with a turtle back forward, and deckhouses on upper deck for officers and passengers. The vessel will be fitted by the Fairfield Company with a set of triple-expansion engines, with three inverted cylinders, direct-acting, with surface condenser, H.P. cylinder, 22 in.; I.P., 36 in.; and L.P., 57 in. by 3 ft. 6 in. stroke. Steam will be supplied by two cylindrical tubular boilers, with three corrugated furnaces in each, and adapted for a working pressure of 150 lbs. The steamer is fitted with all the latest improvements for comfort of passengers and working of cargo, to pass Board of Trade and Bureau Veritas surveyors. As the vessel left the ways she was named the *Devawongse* by Mrs. Davidson, of Edinburgh.

Fremona.—On November 15th a steamer named the *Fremona*, built for Messrs. William Thomson & Sons, was launched from the shipbuilding yard of Messrs. Gourlay Brothers & Co., Dundee. The vessel, which is of steel, has been built under special survey of Lloyd's registry to class 100 A1. She is to have two masts, and will be schooner-rigged. She is of the three-deck type, and possesses water-tight bulkheads, and is provided with water ballast on the cellular system. Her length is 328 ft., breadth, 42 ft., and depth of hold 27 ft. She is to be fitted with triple-expansion engines of 320 N.H.P., with three cylinders of 26 in., 41 in., and 66 in. in diameter respectively, the length of stroke being 4 ft. Steam will be supplied by two multitubular double-ended boilers, which will have a working pressure of 160 lbs. per square inch. Of about 3,000 tons gross register, the vessel has been designed to provide the largest carrying accommodation possible for her size. Under the command of Captain Alexander Anderson, formerly of the *Escalona* (s.), belonging to the same owners, the *Fremona* will be employed as a general trader.

Mount Park.—On November 16th a steamer named the *Mount Park*, built to the order of Messrs. J. & J. Denholm, Greenock, was launched from Craigie shipyard, Dundee, by Messrs. Pearce Brothers. The new steamer is 179 ft. long, 26 ft. broad, and 13 ft. 10½ in. deep in the hold; she is 353 tons register, and 583 tons gross. She has been built of iron to the highest requirements of Lloyd's, and is fitted with all the newest appliances for the rapid handling of cargo. Her engines are to be triple-expansion of 100 N.H.P., and a speed of 11 knots per hour is expected to be attained. The steamer is principally to be employed in the Continental sugar trade, and is to be placed under the command of Captain Arter, who has superintended her construction. When the steamer left the ways she was christened the *Mount Park* by Miss Peden, Greenock.

Mary.—On November 17th there was launched from the shipbuilding yard of Messrs. A. Hall & Co., at Aberdeen, a steam tug of the following dimensions:—Length, 60 ft.; breadth, 12 ft. 6 in.; depth, 6 ft. 6 in. The vessel is built of steel, and will be fitted with steel boiler and compound surface condensing engines of 20 H.P., with a working pressure of 100 lbs. She has been registered to the highest class of Lloyd's and has a Board of Trade certificate for carrying passengers. The tug was built to the order of Messrs. C. Whittall & Co., of Smyrna, and will be engaged in towing in the Mediterranean and supplying vessels with fresh water, for which latter purpose she is fitted with two separate compartments for carrying the water, and has also special pumping facilities. The craft will also be fitted up with the electric light, and she is expected to attain a speed of 10 knots an hour. On leaving the ways the vessel was named the *Mary* by Miss Frances Adam, daughter of Mr. Francis Adam, shipowner, Aberdeen, who is agent for Messrs. Whittall & Co. in this contract. The *Mary* is 30 tons gross, and will proceed to Smyrna on being completed.

LAUNCHES.—Irish.

Lycia.—On November 5th Messrs. Harland & Wolff launched from their shipyard, Queen's Island, Belfast, a screw steamer for Messrs. D. & C. MacIver, of Liverpool. The new steamer is named the *Lycia*, and is of the following dimensions:—Length of keel and forerake, 345 ft.; breadth of beam, 40 ft. 9 in.; gross tonnage, about 3,150. She will class 100 A 1 at Lloyd's, and be fitted with all the most recent improvements, including triple-expansion engines of the newest and most approved type, which are also being constructed by Messrs. Harland & Wolff. The *Lycia* is a sister ship of the *Etolia* (s.), launched from the Queen's Island yard some little time ago for the same owners, and will, like her, be employed in Messrs. D. & C. MacIver's Bombay trade.

Patrician.—On October 19th a steel three-masted schooner was launched from the shipbuilding yard of Mr. Paul Rodgers, at Carrickfergus. The vessel has been built under special survey to the order of Alderman P. Tiernan, J.P., of Drogheda. Her length is 120 ft., breadth 23 ft., depth 10 ft. 6 in., and carrying capacity about 300 tons. She has three water-tight bulkheads, and is fitted out with every modern appliance. The ceremony of christening was performed by Miss Tiernan, daughter of the owner, who named the vessel the *Patrician*. The ship is intended principally for the foreign trade, and will be under the command of Captain Whitehead. She will receive her entire outfit in Carrickfergus.

LAUNCH.—Danish.

Sonderjylland.—On October 29th a new steamer was launched at the shipyards of Messrs. Burmeister & Wain, Limited, Copenhagen. The steamer is built for the United Steamship Company, Copenhagen, and was christened *Sönderjylland*. She is 165 ft. long, 23¾ ft. broad, and has a depth of 12 ft. The new boat will be engined by Messrs. Burmeister & Wain on the triple-expansion system. She is fitted with patent steam windlass by Messrs' Emerson, Walker & Thompson Brothers, London, and is intended for passenger and goods traffic.

TRIAL TRIPS.

Norfolk.—On October 20th the steamer *Norfolk*, 300 tons gross, built to the order of Messrs. Clarke & Reeve, Yarmouth, by S. M'Knight & Co., Ayr, and engined by William Kemp, Govan, left Ayr to adjust compasses and have speed trial on the measured mile at Skelmorlie. This vessel has been designed for a high rate of speed for the passenger service and general trade between Yarmouth and Hull, and loaded with 26 tons cargo beyond the guaranteed deadweight capacity, she attained at the trial an average speed on three runs of 10¼ knots per hour, which was considered highly satisfactory, two of the runs being against a strong head wind.

Bellona.—On October 22nd the trial trip took place of the *Bellona* (s.), 330 ft. by 38 ft. by 25 ft. 3 in.; 1,350 tons deadweight; built by C. S. Swan & Hunter, Wallsend, for the Deutsche Dampfschiffs Rhederei zu Hamburg, and engined by Messrs. R. & W. Hawthorn & Co., with engines 24 in. by 37½ in. by 64 in. and 42 in. stroke, 1,400 I.H.P. A mean speed of 11·9 knots was attained.

Tenasserim.—On October 26th a trial of the steamer *Tenasserim* was made on the Clyde with satisfactory results. This trial was of more than usual interest, from the fact that the *Tenasserim* is the first steamer whose machinery has been altered under the system patented by Mr. Walter Brock, of the firm of Messrs. Denny and Co. This system may briefly be described as one which, it is claimed, enables the ordinary type of compound marine engine to be converted in the cheapest possible manner into the most efficient coal-saving, high pressure engine of the modern kind. All that is necessary to effect this change is the removal of the old boilers and cylinders, and the substitution for them of high pressure boilers and four new cylinders, so arranged as to occupy the place of the removed cylinders without alterations to any of the existing valve or other gear. Under Mr. Brock's patent these cylinders are arranged tandem fashion, No. 1 sitting on top of No. 2, and No. 3 on top of No. 4. No. 1 forms the cover of No. 2, and No. 3 the cover of No. 4, and there is no exposed stuffing box between the top and bottom cylinders. The valves for all the cylinders are arranged in the casings of the lower cylinders, so that there are no more stuffing boxes and the like to attend to in the engines as altered than was the case before the alteration was made, rather less, as the piston rods are not carried through the top cylinders. The steam is expanded through each of the four cylinders in succession, beginning at No. 1; and to distinguish this system from the three cylinder type now so common, and known as triple-expansion, it is designated "quadruple-expansion." The trial justified all the expectations formed by those interested. With the same engines, except for the substitution of new cylinders, as noted, and new boilers, an increase of power to the amount of 40 per cent. was developed, with a corresponding increase in the speed of the vessel. The engines worked with perfect smoothness and regularity, and they are fitted with Messrs. Weir's pumps, feed-heater and distiller. Time did not admit of a consumpt trial being taken, but a decrease of fuel burnt of at least 30 per cent. per I.H.P. is expected. During the trial the *Tenasserim* was fully loaded for sea, and she maintained with ease a speed of 11¾ knots, as ascertained by trials made on the measured mile at Skelmorlie, under very unfavourable weather conditions, half a gale of wind blowing. The cabin arrangements have also been altered, and a large deckhouse fitted aft. Electric lighting and electric bells have been fitted throughout the steamer.

Perseverance.—On October 26th the *Perseverance*, the second of two twin-screw steamers of 690 tons and 750 I.H.P., just completed by Messrs. Laird Brothers for the Amazon S. N. Company, made her official trial trip at the mouth of the Mersey. The company was represented by Admiral Sir E. A. Inglefield, R.N., K.C.B., and Captain Boulton, who will have charge of the steamer to her destination, was also on board. The trial was extremely satisfactory, the vessel carrying her stipulated weight on the intended draught of water, being remarkably free from vibration and very handy in steering. The mean speed attained was 12½ knots, which was half a knot in excess of that guaranteed under the contract.

Courier.—On October 28th the official speed trial took place of this steamer, built by Messrs. C. S. Swan & Hunter, Wallsend, for Messrs. Huddart, Parker & Co., Melbourne, and engined by Messrs. R. & H. Hawthorn, Leslie & Co. The *Courier's* dimensions are:—Length, 220 ft.; breadth, 30 ft.; depth, 13 ft. An average speed of 21 miles per hour was attained on a four hours' run in rather rough weather, the engines working most satisfactorily, indicating over 3,000 H.P., with a single screw, and the ship being free from any vibration.

Gulf of Trinidad.—On October 28th the screw steamer *Gulf of Trinidad*, built by Messrs. Raylton, Dixon & Co., at Middlesbrough, for the Greenock Steamship Company (Limited), of Greenock, sailed for Antwerp, after a successful trial trip, an average speed of 12½ knots on the measured mile being obtained. She is built on the three-deck rule to the highest class of Lloyd's, of the following dimensions:—Length, 312 ft. 6 in.; by 40 ft. by 25 ft. 2½ in., and will carry 3,500 tons. She has water ballast in chambers, long poop bridge and forecastle extending almost the whole length, and every convenience up to the most modern style for a first-class merchant steamer. In addition she is fitted with saloon and cabins for 30 first-class passengers. She has triple-expansion engines of 350 N.H.P., by Messrs. Blair & Co. (Limited), Stockton.

Mogul.—On October 29th the screw steamer *Mogul*, which was lately built by Messrs. Aitken & Mansel, Whiteinch, and engined by Messrs. John & James Thomson, Glasgow, had her official trial trip on the Firth of Clyde. The vessel is owned by the Mogul Steamship Company (Limited), the managers of which are Messrs. Gellatly, Hankey, Sewell, & Co., London, and is about 3,300 tons, and measuring 335 ft. by 40 ft. by 26 ft. She is fitted up in a manner suitable for the Eastern and Australian trade. The engines are of the triple-expansion type, having three cylinders working on three cranks. Steam is supplied to the engines from two large steel boilers having twelve of Fox's corrugated furnaces. The engine shafts are built. Notwithstanding the boisterous state of the weather a speed of 12¾ knots per hour was obtained.

Colorado.—On October 31st the Wilson Liner *Colorado* went out on her trial trip. At high water the vessel left the Alexandra Dock, Hull, and proceeded down the river as far as Grimsby, off the hydraulic tower of which seaport she anchored. At half-past nine a tender left the Corporation Pier for the vessel, conveying a large party of ladies and gentlemen. The wind blew cold and strongly from the W.S.W., but the water was perfectly smooth. The *Colorado* was under the command of Captain Jenkins, who will retain the command of her. She is of 4,300 gross and 2,778 nett register tonnage. Her weight exceeds 3,000 tons, and she will carry 5,200 tons of cargo, so that her weight when loaded will be about 8,500 tons, and she will be propelled through the water at the rate of about 14 knots per hour. The *Colorado* is 375 ft. in length, and if she were placed upon the ground the top of her stem would be only a few inches short of 50 ft. from *terra firma*. Her deck is flush fore and aft. The vessel is rigged as a three-masted brigantine, her sails being composed of Thompson's hurricane canvas. Her engines are of the triple-expansion class, and there are three boilers, with 15 furnaces, supplied with Henderson's patent mechanical bars. As soon as the company reached the *Colorado* a course was steered towards Withernsea, where it was intended to run the measured mile. At first the vessel went under very easy steam, but this was gradually increased until, with 66 revolutions, 13¾ knots was obtained by the log. Time, however, in consequence of the *Colorado* having to be in dock by a certain hour, did not permit of Withernsea being reached, and off Dimlington the vessel was turned, and proceeded on her homeward voyage. Arriving off Grimsby, a couple of hours was spent in adjusting the compasses, and, finally, after a most successful trial, the *Colorado* returned to the Alexandra Dock.

Drysdale.—On November 2nd the *Drysdale*, a screw tug, built by the Abercorn Shipbuilding Company, made its trial trip on the Gareloch. It attained a speed of 12 statute miles per hour, which was regarded as satisfactory. The tug is intended for the River Plate, and is to carry mails and passengers to and from steamers. She will also be used for towing purposes. Her dimensions are:—Length, 80 ft.; breadth, 17 ft.; and depth 9 ft. 6 in. She is provided with surface-condensing engines of

45 N.H.P., which were constructed by Messrs. Hanna, Donald and Wilson.

Zaroeta Primero.—On November 2nd the speed trial of the steel screw steamer *Zaroeta Primero* took place on the Gareloch. This is a smart passenger steamer built for river work in Spain, and measuring 63 ft. by 12 ft. 3 in. beam. The engines are of the compound type, having cylinders of 7 in. and 13 in. in diameter respectively, with piston stroke of 9 in. They are fitted with Bremme valve gear for reversing and expansive working. Messrs. Ross & Duncan, Whitefield Works, Govan, were the contractors for the vessel, the hull of which was built by Mr. William Cumming, Monkland Canal, Glasgow. A mean speed of 9·35 miles an hour was attained, and the trial was in every respect very successful.

Benguela.—On November 8th the Royal Mail steamer *Benguela*, of the British and African Steam Navigation Company, had a very successful trial trip from the Mersey. The *Benguela* has for the past few months been in the hands of the well-known engineers and shipbuilders, Messrs. Fawcett, Preston & Co., who have thoroughly overhauled both the engines and the hull, and supplied new boilers, as well as converted the engines into triple-expansion of the most recent three-crank type. The reversing is effected by direct steam reversing engines of Messrs. Fawcett's special make. The steamer left the Mersey on Tuesday morning, under the command of Captain William Jolley, and having also on board, in addition to Messrs. Fawcett & Preston's representative, the following gentlemen:—D. H. Holman, Board of Trade surveyor; A. C. Stuart, Government engineer for West Africa; Captains Griffiths and J. F. Brown, Mr. James Robinson, Mr. J. Steele, marine superintendent to the British and African Company; Mr. J. Blackburne, superintendent engineer to the African Company; Mr. John Harrison, and a number of gentlemen from the office of Messrs. Elder, Dempster & Co., the agents for the steamer. The trial was conducted by Messrs. Fawcett, Preston & Co., under the supervision of Mr. J. J. Wilkie, the superintendent engineer for the owners of the vessel. The trial lasted about seven hours, and from first to last was of a most satisfactory nature. The engines which are constructed to the specification of Mr. J. J. Wilkie, worked with remarkable smoothness, and even when they were going at the highest speed there was an almost entire absence of vibration in any part of the steamer, whilst the engines themselves were perfectly free from any heating. No attempt was made to unduly push the vessel, but she comfortably travelled at a steady pace of about 12½ knots per hour. The cylinders are respectively 21 in., 34½ in., and 55½ in. in diameter, and 3 ft. stroke. Steam of 160 lbs. pressure is supplied from two large boilers, 13 ft. 6 in. in diameter. The averge vacuum was 27½ in., and the speed 70 revolutions. From the result of the trial it is confidently anticipated that a saving in coal consumption of from 20 to 25 per cent. will be effected by the conversion.

Liddesdale.—On November 9th the new steel steamer *Liddesdale*, owned in Glasgow by Messrs. Robert Mackill & Co., went down the Clyde on her trial trip, preparatory to starting on her first voyage to Rangoon. The vessel, which was fully laden and in good sailing condition, was built by Messrs. Charles Connell & Co., Whiteinch, and engined by Messrs. John and James Thompson, is 300 ft. long, 40 ft. broad, 24 ft. 6 in. deep, with a gross registered tonnage of about 2,600, and while on her trial carried 3,800 tons of coal. The *Liddesdale* has been built to the highest class at Lloyd's, under special survey, and fitted up with all the most modern improvements for rapid loading and discharging cargo, including patent steam-steering gear, by Messrs. Porteous, Paisley, and the Atlas marine telephone, for keeping up communication between the bridge and the ship's stern. She is also constructed on the cellular double-bottom system, and capable of carrying water ballast fore and aft. Accommodation is provided for a few passengers in the poop, and for the officers and engineers under the bridge amidships. The engines are of the most improved triple-expansion type, having cylinders 23·37 and 59 by 42 stroke, with a working pressure of 160 lbs. to the square inch. The vessel was tried first on the measured mile at Skelmorlie, where she attained a speed of 10·588 knots per hour, and afterwards ran the lights at the rate of 10 knots per hour. The coal consumption was also tested, and found to be 15 tons per 24 hours, a result which was considered very satisfactory by all on board.

Viceroy.—On November 10th, this vessel, which has been built and engined by Messrs. W. Doxford & Sons, sailed from Sunderland, with a cargo of 2,000 tons of coke. Before proceeding on her voyage, she was taken over the measured mile, when a regular speed of 9½ knots was easily maintained, giving great satisfaction to all concerned.

Lahn.—On November 12th this vessel, the ninth of the Atlantic fleet of the Norddeutscher Lloyd, built at the Fairfield Yard, Govan, left the Clyde for Bremen. The *Lahn* is 6,500 tons burden, and steamed on the measured mile 19·46 knots. On a six hours' run she steamed 18·75 knots, with a coal consumption of 1·6 lb. per horse power. Her engines, like the three previous vessels of this line, are triple-expansion, but they are in this instance novel in arrangement. There are two small high pressure cylinders placed on the top of the low-pressure cylinders, with the piston rod running through both, tandem fashion. The glands on the top of each low-pressure cylinder are, with the glands on the bottom of its companion high-pressure cylinder, enclosed in a steam-tight casing, and the two pistons act as guides for each other, thus obviating the necessity for a guide-rod proper in the high-pressure cylinder. The intermediate cylinder stands between the two pairs of high and low-pressure cylinders. The arrangement works with much greater smoothness and efficiency, and will probably become the generally adopted type in the future of triple-expansion engines of large size. The *Lahn* is 446 ft. long, 48 ft. beam, and 37 ft. deep. The speed attained exceeded that contracted for by three-quarters of a knot, and places her as the third fastest steamer on the Atlantic. The *Umbria* and *Etruria* maintain their places as the fastest, but the *Alaska*, which has hitherto held the third place, must now make way for the *Lahn*, and take fourth position.

St. George.—On November 18th the new combined hopper dredger *St. George*, built by W. Simons & Co., Renfrew, was put on her trial in the mid-harbour, Port Glasgow, in presence of one of the owners, and both in the dredging operations and her speed on steaming down the river afterwards was highly satisfactory. The *St. George* has been constructed to carry 300 tons material, which she can raise in about an hour. One of the specialities of this vessel is that she cuts her own flotation by the buckets being in advance of the vessel, and is specially adapted for working close to quay walls, and, if required, to cut a channel through a dry bank.

Auricula.—On November 19th the *Auricula* (s.), recently built by Messrs. John Blumer & Co., Sunderland, proceeded to sea and had a successful trial trip. The vessel is built to the highest class of Lloyd's, and is of the following dimensions:—Length, 240 ft.; breadth, 33 ft.; depth, moulded, 17 ft. 4½ in. The vessel is intended for the general carrying trade, and has a deadweight carrying capacity of 1,750 tons. She has long poop, bridge, and topgallant forecastle, with accommodation aft for captain and officers, amidships and under forecastle for engineers and crew respectively. The deck fittings include two steam winches by Messrs. Clark, Chapman & Parsons; two steam winches and patent steam steering gear by Messrs. R. Roger & Co., Stockton; and hand screw steering gear by Messrs. G. D. Davis & Co., of London. Her engines, which gave every satisfaction, are of 120 N.H.P., and are by Messrs. J. W. & F. Wilson.

Portland.—On November 21st, the steamer, *Portland*, built by Messrs. W. B. Thompson & Co. (Limited), for the Clyde Shipping Company, left Dundee, and made a run to the Buoy of Tay and back to test her machinery. All the machinery was found to be in perfect working order, and a speed of 13¼ knots per hour was attained. During the outward trip the opportunity was taken to make an examination of the vessel, and the highest satisfaction was expressed with her smooth running, only a slight tremor being felt while the engines were going full speed, and the whole appointments and the substantial character of the work called forth general commendation. The *Portland* left Dundee in the evening for Glasgow, to load for London. She is under the command of Captain Crawford, commodore of the company, who has been thirty years in their service.

Kronprinz Friedrich Wilhelm.—This vessel, one of the fleet of the Norddeutscher Lloyd, recently had her machinery converted to the quadruple-expansion system of the type patented by Mr. Walter Brock, of the firm of Messrs. Denny and Co., Dumbarton. The new cylinders, boilers, &c., were made in Dumbarton by Denny & Co., and shipped to Bremerhaven, where they were fitted to the old engines by the owners. The cylinders are of the following dimensions:—21½ in. by 30½ in. by 43 in. by 61 in. by 48 in. stroke, and are supplied with steam at 170 lbs. pressure by two double-ended boilers. The trials took place on November 7th, on the Weser, when highly satisfactory results were obtained. Tested on the measured mile, and between lights,

the vessel maintained a mean speed for six hours of 13·19 knots, a considerable increase over her previous performance, while the consumption, trials of which were made at the same time, thoroughly satisfied the representatives of the Norddeutscher Lloyd. Owing to the greatly increased economy of the engines the owners have been enabled to convert a considerable portion of the coal bunkers into cargo space.

Rattlesnake.—The *Rattlesnake* has completed her series of progressive engine trials for the information of the constructive department of the Admiralty. She began at the slow speed of eight knots, and worked up to her highest possible speed by increments. The ship had been previously docked, and on the last day she realised a speed of 20 knots, the highest she has attained. During the trials she fractured one of her eccentric straps, and on several occasions it was necessary to draw fires through a failing of the feedwater.

Correspondence.

[It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.—ED. M. E.]

FORCED DRAUGHT.

To the Editor of THE MARINE ENGINEER.

SIR,—I have just returned home and received the September and October numbers of THE MARINE ENGINEER, and beg to trouble you with a few remarks on the article relating to forced draught.

The writer of the article claims that "the only plan that seems to hold its own is the closed stokehold system." Can he give one instance of a vessel making, say a ten days' voyage, and working continuously under the "closed stokehold system?" If not, how can he say that that system is "holding its own," when it has never been tried? The writer then proceeds to point out several defects in his favourite system, among others, the difficulty of getting rid of the ashes. It seems that two doors have to be manipulated in getting a bucket of ashes overboard; this may do in the Royal Navy, but I am afraid we have neither time nor men in the Mercantile Marine for such an intricate performance. Again, the writer says, "In cleaning the fires there is no way of shutting off the strong current of cold air from passing into the furnace and tubes." This is important, and ought to be borne in mind. The writer, however, honestly states that "with other systems" (which presumably have *not* "held their own") "the blast can be shut off from each fire individually as required." He then goes on to state that with the "closed stokehold system, the temperature of the boiler-room is very great when working under ordinary natural conditions." Well, Sir, it no doubt would be warm, very warm. I should not care to be within earshot of a few able-bodied firemen whilst they were expressing their opinions on such a stokehold under "natural conditions," say in the West Indies; and that is a pity, since this is the "only system that seems to hold its own." Again, the writer says, "The practical experience with forced draught has, so far, not been a very happy one, as with scarcely a single exception, marine boilers have not been able to work many hours consecutively without requiring either their tubes rolled or seams caulked." Now, Sir, I believe this has been the result, the invariable result, of working with the "closed stokehold system." The writer evidently ignores other systems; but if he will communicate with me, I will show him a marine boiler fitted with Howden's system of forced draught, which has been in constant use since October, 1884, on voyages from London to the West India Islands, occasionally extending to British Honduras, the voyage taking from three to four months, under steam all the time. The loss of feed water is made up from the sea in the usual way, not a drop of fresh water being put in the boiler during the voyage, and this is done without the necessity of "rolling tubes and caulking seams;" in fact, the boiler, including fan engine and fan, has not cost five pounds since it left the maker's hands, and is now in first-class condition. I will now point out some of the advantages of this system. The consumption of fuel is greatly reduced; the fire-bars last very much longer one hundred tons of cargo space is saved from original boiler space; no trouble in changing from forced draught to natural draught; whether the fan is working or not does not matter one straw to the men in the stokehold, as far as temperature is concerned; the stokehold is open as with a natural draught boiler; no danger from unequal pressure in two stokeholds; no doors to manipulate in putting out ashes; full control of the quantity of air to be admitted either *above* or *below* the bars; and others too numerous to mention here.

I wish to say that I do not know Mr. Howden, have never seen that gentleman to my knowledge, and have had no communication with him whatever, and that my only object in writing this letter is to show your readers that there is another "system" besides the "closed stokehold system" that "seems to be holding its own."

There is just one other point I should like the writer of the article to explain. On page 196 he remarks, regarding Howden's system: "The fact of heating the air to a temperature of 200° before it enters the furnace, cannot go very far in effecting either the rapidity or the completeness of the combustion of the fuel." On page 233 he says, "One of the chief losses of heat in a boiler is caused by radiation from the plates of the boiler; in an open stokehold the air that is thus heated by radiation escapes in many ways, but in a closed stokehold its only egress is through the furnace, where it is rather beneficial in promoting quicker combustion, *owing to its higher temperature.*" I suppose I am rather stupid, but I really cannot understand why the air heated by Mr. Howden's system should not be as beneficial in promoting quicker combustion, "owing to its higher temperature," as air heated by radiation from a boiler in a closed stokehold.

In conclusion, I beg to thank the writer most sincerely for pointing out the many defects in his favourite system. Whatever his original intention was, he has certainly succeeded in convincing any practical man that a system of forced draught that necessitates the "rolling of tubes and caulking of seams" after a few hours' use, not to notice the other "drawbacks" he mentions, is not suitable for the Merchant Service, and I can prove to him that there is at least one other "system" that has been in constant use for years, and is still "holding its own."

I am, Sir, yours respectfully,
JOHN P. MATTHEW.

S.S. NEW YORK CITY,
London, *Oct. 29th*, 1887.

FORCED DRAUGHT.

To the Editor of THE MARINE ENGINEER.

Sir,—This subject having been referred to in the September and subsequent issues, and a general survey taken of the various systems employed, and as my name is mentioned in connection with them, a few remarks from me may not be out of place. What is most extraordinary about this subject is the manner by which it was introduced into the Navy. It appears that an official from the Admiralty witnessed some experiments in France with a marine boiler, and came to the conclusion that it would be suitable for war vessels. From what has followed it will be seen that it was forthwith adopted by the Admiralty without further inquiry. Although it has been an established rule to submit everything new to a crucial test before adoption in the Navy, yet in this case nothing of the sort was done. Never since marine engineering began has there been so many errors made and such costly blunders committed. The cost to the country must be something enormous. Take a single case, viz., that of H.M.S. *Polyphemus*, a first-class torpedo ship, which was supplied with ten large boilers upon the locomotive type, and fitted with forced draught and closed stokeholds; great expectations were entertained respecting the efficiency of her appliances. Most of your readers, no doubt, have read the report of this failure and the fruitless endeavours in trying to make the boilers succeed. As usual, the engines and boilers were completed and the iron decks built over them just the same as would be done with any commonplace job, none considering that they were dealing with an impossibility; and when every device had failed it was determined to remove the boilers and substitute others of a different type for them. But this question of removal was a serious matter; some thought it would be cheaper to cut a hole in the bottom of the ship to let them through rather than cut away the iron decks above; finally the latter was resolved upon. The magnitude of this error seems to have alarmed the scientific branch of the

Admiralty, and in order to prevent a repetition of it they deemed it advisable to consult four of the leading locomotive engineers of our railways. What advice these experts gave was not made public. The locomotive is the highest example we have of induced draught, a practice just the reverse upon which their advice was sought. Notwithstanding the lessons taught, the same policy has been continued regardless of the results. Take another instance of the late experiments with the flotilla of torpedo boats. They were put on an eight hours' run. No. 47 burst her boiler and killed some of her crew. No. 50 brought the crown of her furnace down, and others got more or less damaged and had hairbreadths escapes; little or nothing has been heard of them since, neither are the numerous accidents, continually occurring, reported. A more precarious and uncertain system for marine boilers could not be devised, yet amongst its advocates are to be found naval architects and marine engineers, who, from their position, might be supposed to be capable of discerning the correctness of their views upon such subjects. As the Admiralty have decided to adopt forced draught for war vessels there will be found plenty to cater for them, and if the contract speed and power can only be maintained for four hours it would ensure the reception of a ship, although it may never be possible to accomplish it again afterwards.

Our supposed fast ships generally steam on reduced steam power, or are laid up in reserve; it is admitted by the Admiralty authorities that forced draught is only required for spurting. They have had sufficient experience by what has already happened to teach them that it would be highly dangerous to steam full speed for many hours successively. It is quite understood that economy has not been considered in adopting the system for naval purposes.

It is difficult to believe that any of the advocates or writers upon forced draught have ever spent an hour in the stokehold on full speed. On all official trial runs I have attended, I have not found anyone willing to remain five minutes with the stokers, although I have been testing and indicating boilers for over forty years, and must say that a strong feeling of insecurity comes over me on entering the boiler-room with forced air and closed stokeholds.

As I made the marine boiler a speciality it became necessary for me to investigate into every particular respecting them. In no case have I found indications of the boilers taken on official trials other than I have taken. As long as the engines could be driven full speed for a few hours, but little attention is paid as to how the steam is obtained.

The evidence is clear against forced draught for marine boilers; in fact, they become unsafe under the process as has been proved. By forcing the fire the furnace is converted into a battery, and the tube plate into a target exposed to the full force of the heat generated. The resistance in the tubes also having to be overcome causes the heat to impinge severely on their orifices. It is the tube plate which suffers most, as there is a constant pressure against it according to the force of air supplied. The dust and cinders also are kept alive in the furnace, and soon choke up all the spaces at the back of the fire.

The fans being driven by high speed engines consume an enormous amount of steam. In the case of H.M.S., *Anson*, over 60 per cent. more coal was consumed on her late trial to produce a bare knot to her natural draught speed.

Most engineers are aware that marine boilers require assisted combustion. It was usual in our old practice to put a steam jet in the base of the funnel to induce draught, which answered very well; but modern engineering required its discontinuance before any substitute for it had been devised. It is to this that I have devoted considerable attention the past two years, and for the purpose of experimenting have put down a marine boiler, so that it could be worked continuously without interruption and submitted to crucial test not possible in a ship. The result has shown that marine boilers are as capable as locomotives to endure high temperatures on the induced draught system for rapid steaming, without the injurious effects produced by forcing which localizes heat; it is the same by blowing any fire, the heat is concentrated where the air strikes, it is unsuited for covering large heating surfaces contained in marine boilers.

With regard to the remarks made in the September issue, page 196.—" Mr. Martin, the inventor of the well-known furnace doors, substitutes a fan in the uptake for a steam jet, and so arranges his funnel, that in the event of the forced draught not being required, the gases of combustion arising from natural draught will not be impeded in their exit to the atmosphere. He claims for his invention that it does away with all necessity for closing in the stokeholds or furnaces, and that in war ships funnels could be dispensed with, as the gases and smoke could be discharged anywhere from the fans. He also claims that by his plan of producing a draught, the boiler tubes become much more efficient as heating surfaces, and that the ends of the tubes in the fire-box are not so liable to be burnt away, and that therefore there will be less chance of the boiler leaking round the tubes. There appears to be some grounds for these latter assumptions, for it is a well-known fact that the tubes of locomotive boilers, which are worked, as we have seen, on the exhaust principle, do very much more work than those of marine boilers before they are ferruled or rolled. It can also be shown, by a very simple experiment, that when the gases are sucked or drawn through the tubes, the flame extends a much greater distance along the tubes than when the gases are driven through the tubes. In this latter case the flame impinges on the tube plates before separating into tongues and entering the tubes; but when sucked through, the tongues of flame commence at some little distance from the plate before penetrating the tubes, and the ends are not therefore burnt as when the flame impinges directly on them. It may be urged, however, against Martin's system, that owing to the greatly increased volume of the products of combustion due to their temperature, fans of from three to four times the size of those used in other systems are required; also, that the uptakes have to be made larger and heavier to take in the fans; and lastly, that the fans themselves are likely to be quickly rendered inefficient through working in a temperature of at least 1,000°. These objections prove so formidable that up till the present time Martin's plan of creating a forced draught has made little or no headway."

Suffice it to say that none of these difficulties have been experienced, the fan does not suffer in the least, the temperature in the funnel is about 450°, and when the fan is working it defends itself, and the temperature is much less. I can see no difference in one that has been in use eighteen months.

The steamship *Olive Branch*, mentioned in last month's issue, only required a 6 ft. fan driven at 400 revolutions per minute, the fan engine at 100; but this could be increased at will, requiring but little supervision, and maintained indefinitely for the longest voyage. There were no alterations required either to uptake or funnel for its application.

I am, Sir, yours truly,
W. A. MARTIN,
Poocck-street, Blackfriars-road,
London, S.E.

TRIALS OF TORPEDO BOATS IN THE BALTIC.

To the Editor of THE MARINE ENGINEER.

SIR,—We have received from Russia two numbers of the "Messager de Cronstadt," containing articles relating to the trials of torpedoes recently carried out in the Baltic.

We take the liberty of sending you a translation of these articles, and believe they are exact translations.

Accept, dear Sir, the assurance of our distinguished consideration.

Pro AUGUSTUS NORMAND & CO.
GUSTAVE BRETLE.

HAVRE, *2nd November*, 1887.

EXTRACT FROM THE "MESSAGER DE CRONSTADT" OF THE (22ND SEPTEMBER) 4TH OCTOBER, 1887.

The torpedo boats which were recently submitted to very severe comparative trials by a special commission, under the presidency of Vice-Admiral K.P. Pilkine, were last Sunday ordered back into the yards for disarmament.

The following were the four torpedo boats which were tried:—

1st. The *Sveaborg*, built in Havre in the Normand dockyard.

2nd. The *Vindava*, built at Elbing (Prussia) in the Schichau dockyard.

3rd. The *Viborg*, built in England by Messrs. Thomson.

4th. The *Kotline*, built in the Government dockyards of the New Admiralty at St. Petersburg.

The tests were begun by trials for speed. The torpedo boats were despatched to Revel, running through a heavy storm, repeating the speed trials during three successive hours for the final tests of the engines.

All these trials were kept up from the 11th to the 16th of September. They were carried out under the most varied conditions of weather and sea, and the results attained were beyond dispute.

We shall devote a special article in our next number to these results. For the present, we will content ourselves with observing that the victor in the contest was the *Sveaberg*, built at Havre, in M. Normand's shipbuilding yard.

EXTRACT FROM THE "MESSAGER DE CRONSTADT" OF THE (27TH SEPTEMBER) 9TH OCTOBER, 1887. (No. 114.)

In number 112 of the "Messager de Cronstadt," we promised to say something in reference to the comparative trials with the torpedoes.

Here are the facts we have been able to acquire in regard to the said trials.

The trials were continued from the 11th to the 16th of September.

Four torpedo boats only took part in the trials, viz.:—

1st. The *Sveaberg*, built in the Normand dockyards at Havre.

2nd. The *Vindava*, built in the Schichau dockyard at Elbing (Prussia).

3rd. The *Viborg*, built to the order of the marine department in the dockyards of Messrs. Thomson, in England.

4th. And, lastly, the *Kotline*, built in the Government dockyards of the New Admiralty at St. Petersburg.

The fifth torpedo boat, the *Lachta*, took no part in the trials, owing to an accident to her screw propeller.

Before commencing the trials, the torpedo boats took in a full supply of coal, namely:—

The *Viborg*, 44 tons, enough for 1,300 miles at average speed (12½ knots).

The *Sveaberg*, 30 tons, enough for 2,800 miles at average speed.

The *Vindava*, 18 tons, enough for 1,000 miles at average speed.

The *Kotline*, 15 tons, enough for 400 miles at the same speed.

On the morning of the 11th of September the torpedo boats steamed out of the Port of Milieu, and having come up with the S.S. *Ilmen*, commissioned from St. Petersburg, they started on the speed trials about one o'clock p.m. At this moment the commissioned steamer neared each of the torpedoes, and made each run a given distance three times. The diagrams were then taken of the work and of the engines.

Here, as in the previous trials at Revel, all the advantage lay with the *Sveaberg*, whose speed was only one knot below the acceptance speed, in spite of her triple cargo.

As to the *Viborg* and the *Vindava*, this difference amounted to 5 knots, and in the case of the *Kotline* it was 2½ knots.

After the speed trials, all the torpedo boats, accompanied by the cruiser *Asie*, started about two o'clock for the Revelstein lighthouse, in order that, having had a good long run, and having been about 48 hours at sea, they might return thence, and be submitted to the final trial for maximum speed, under the most disadvantageous circumstances, both for engines and boilers.

The course to Gothland was run very successfully under a N.E. wind, having a force of 5.

A little before 3 a.m., on the 12th of September, the wind began to freshen, and soon after reached storm point, bringing on a very heavy sea. The *Vindava*, which was under the command of Captain Babnof, a commander of the second class, failed to weather the storm, and was compelled to run for shelter behind Gothland island, where she anchored.

The other torpedo boats kept their course, but not being all gifted with the same turn of speed, they failed to keep together very long. The *Sveaberg*, commanded by Captain Zaleski, an officer of the second-class, took the lead, while the *Viborg* and the *Kotline* were running together astern.

During the morning of the 12th, they experienced a storm in the full sense of the word.

The wind blew from the N.E., increasing up to 10 points of force, and the darkness and fog became so intense that the outlines of the coasts were not distinguishable even at a short distance.

The *Viborg* and *Kotline*, having afterwards sighted Nargen island ahead, were compelled to run out to sea so as to make the northern point of the island.

Just at this time a slight mishap occurred to the *Kotline's* engines, owing to which she had to dispense with one of her propellers.

After having successfully rounded Nargen lighthouse, the two torpedo boats cast anchor in order to shelter themselves from the tremendous N.E. wind.

As for the *Sveaberg*, she was carried up to the southern point of Voulf island, where she had to battle with the waves for nearly two hours.

After coming successfully out of this trying ordeal, the torpedo boat made Revel, and got into port about two o'clock in the afternoon.

On the following day, the 13th September, the other torpedo boats arrived in the port of Revel, as did also the *Asie*, who had waited behind Nargen island owing to the fog.

To judge of the force of the storm the torpedo boats had to weather, it will suffice to say that two English merchant steamers were towed into Revel at the time with broken rudder and damaged engine. The steamers referred to were absolutely helpless, and the captains declared that they had never been out in such a storm.

As to the torpedo boats, they weathered the storm bravely, although their crews were well nigh worn out, and badly needed rest.

Vice-Admiral K. P. Pilkine therefore ordered that the next day, the 14th September, should be devoted to rest and to overhauling the torpedo boats.

A taix o'clock on the morning of the 15th, the torpedo boats steamed out of Revel and steered off almost in a calm for Brourkesund. In order to give each a wide berth, they divided into two groups, the faster boats, the *Sveaberg* and the *Vindava* paired off in one direction and the *Viborg* and the *Kotline* in another.

After joining company again behind the Kokscher lighthouse, the cruiser *Asie* steamed ahead from Revel roads, and the *Sveaberg* and *Vindava* taking the lead and gradually increasing speed, got up to an average velocity of 16 knots over the whole run. In this struggle the *Sveaberg* beat her German antagonist, being the first to make Ravitza island.

On the morning of the 16th September the torpedo boats underwent speed trials for the final test as to maximum velocity.

The results of this most interesting trial may be thus stated:— The *Sveaberg* attained a velocity equal to her speed on reception, the *Vindava* 4 knots less, and the *Viborg* 3½ knots less.

Thus superiority in speed in sea-going qualities, solidity of construction and sphere of action (coal supply), rested with the *Sveaborg*, which, though built *abroad*, has proved herself in the trials *in our hands*, the only one which *has retained the same conditions* in which she was when first delivered. This fact is worthy of special attention, as it is a deviation from the rule of the habitual deterioration which torpedo boats built for the State in private dockyards usually undergo very shortly after they are delivered.

It is beyond doubt not only that the Normand dockyard has produced a torpedo boat magnificent in all respects, but also that the crew of the torpedo boat, officers and men, have shown themselves equal to the difficult test of the comparative trials, and have given evidence of that energy and faultless attention requisite for preserving the torpedo boat in the same good trim as when delivered a year ago.

This is the only way in which we can explain the surprising results achieved by the torpedo *Sveaberg* during the period of these trials.

TRIPLE-EXPANSION ENGINES.

To the Editor of THE MARINE ENGINEER.

SIR,—In handing you, enclosed herewith, some reliable data regarding the results obtained with new triple-expansion as compared with old compound engines, as fitted on board two steamers of our fleet, I feel confident of meeting the interest of the readers of your well-known paper, the MARINE ENGINEER, if you were to publish them.

Yours truly,

A. BRIZZOLASI.

NAVIGAZIONE GENERALE ITALIANA, GENOA,
October 26th, 1887.

Two steamers, the *Candia* and *Malta*, belonging to the Navigazione Generale Italiana (Florio-Rubattino), were recently fitted with new triple-expansion engines while undergoing general repairs and alterations at Messrs. R. & W. Hawthorn, Leslie and Co.'s works on the Tyne. These two sister ships, 250 ft. 5 in. by 27 ft. 6 in. by 19 ft. 6 in., and 1,042 tons gross, are intended for the mail service between Naples and Palermo. They have splendid first and second class accommodation, with saloons 8 ft. 6 in. high. There is a large smoking and conversation room on deck; also promenade deck. With the old compound engines, indicating about 900 H.P., the vessels could be driven at a speed of 12·6 knots on trial, with a consumption of 18 tons per day of Welsh coal. On a long run at the trial trip that took place on the arrival of the ships in Genoa, the new engines developed easily 1,450 I.H.P., and a speed of 14·6 knots was maintained on 21 tons consumption only. Particulars of the engines are:—H.P., 24 in.; I.R., 38 in.; L.P., 62 in. by 3 ft. stroke. There has been used Mr. F. C. Marshall's valve gear; steam at 150 lbs. pressure is

[illegible] 3 in. diameter supplied by [illegible] all the boats of the by 14 ft. [illegible] system of fire-bars, [illegible] by means of a fan, and the [illegible] arrived at speak of [illegible] of the triple-expansion [illegible] successful work turned out [illegible] & Co.

ARTHUR'S BEVELLING MACHINE.

To the Editor of THE MARINE ENGINEER.

DEAR SIR,—In your last issue (October), you have been pleased to describe "Arthur's Bevelling Machine." In doing so, you give Mr. Ramage the credit of assisting the inventor *in the* [illegible] *of his idea*.

This is a sad mistake, and misleading. The truth is Mr. Ramage, in his paper on the Bevelling Machine, read before "The Institute of Engineers and Shipbuilders," Glasgow, states that he gives encouragement only to the inventors.

The machine referred to by you as made by Mr. Ramage, never came to birth, as that gentleman knew that unless a machine could be designed to overtake frame bevelling it would be unprofitable, he therefore dropped the idea. *This previous knowledge was never imparted to the writer.*

My idea of a bevelling machine was the result of a *felt want* as a practical shipbuilder, years before it was designed by me. Mr. Ramage deserves all credit for encouragement given to the inventor, as he kindly offered to purchase the first machine that was made that could do its work. This promise, I am pleased to say, was redeemed.

Trusting to your sense of justice to have this matter put right, as it is a tender point with all inventors, and, thanking you sincerely for your able and kind notice of the Bevelling Machine,

I am, yours faithfully,

N. ARTHUR,
The Patentee.

ENGINE DRIVERS OF STEAM PLEASURE YACHTS.

To the Editor of THE MARINE ENGINEER.

SIR, In reading the few remarks passed on engine drivers of steam pleasure yachts, I observe what is said of a shipwright driver, as he is termed, of the steam yacht *Gladys*. I may say that he has for many years had a good deal of experience in engineering and marine work. Although he may not hold a certificate, he may be equally capable of taking charge of such a job, and giving entire satisfaction to the owners, as it seems that the yacht worked far better than in previous seasons when she had certificated engineers.

The captain of *Gladys*, a certificated master, and for years master of large steamers trading across the Atlantic, personally informed me he was better pleased with the care and working of the engines during the time the shipwright driver had charge of them than with any previous engineer that had been with him, and one had previously been a guaranteed engineer in a new steamer with him built on the Clyde.

Yours truly,

AN OBSERVER.

November 19, 1887.

RE MARINE ENGINEERS' UNION.

To the Editor of THE MARINE ENGINEER.

SIR,—There was a meeting in connection with the M. E. Union on Friday, November 18th, in the Assembly Rooms, South Shields, setting forth its objects, benefits, &c.

Mr. Metcalf, of Sunderland, opened the meeting, and called upon Mr. Leask, Hon. Sec. *pro. tem.* of M. E. Union, to address the meeting, which he did. After speaking about the position of engineers, &c., Mr. Leask wanted to know why engineers should not be allowed to dabble (quoting Mr. Leask *re* dabble) in navigation just as much as masters were allowed to dabble in steam. Now may I ask Mr. Leask, or any other engineer, if anyone has ever denied them the right to study navigation, or any other science subject which they felt inclined to study? The reason why masters dabble in steam is not far to seek. Has it never dawned upon Mr. Leask that it is compulsory by Board of Trade? are there not two classes of Masters' Exams., namely, steam and sailing ships?

If engineers as a body are desirous of expanding their ideas, is there not plenty of engineering subjects to study without being so childish as to wish to dabble in navigation, purely because masters in steam are compelled to dabble in steam? It would not look very well for the engineer to be taking the sun at one end of the ship, and the captain taking the sun on the bridge, and the engines to stop on account of a hot bottom end. Query: Would the engineer be raising the position of engineers? Scarcely.

Then he deals with men who wish to go to sea for the first time. Mr. Leask suggests that they shall pass an examination arranged and presided over by some of the members of the M. E. Union. Very good. Now if Mr. Leask means a technical exam. the examiners in the M. E. Union might find themselves not equal to those whom they were examining. If he means a practical exam. with the hammer, chisel, and gland spanner, who qualified the present members? Did the mere fact of being able to cram for a Board of Trade certificate of competency of first or second class qualify them? If so, let Mr. Leask get a syllabus of last May's Science Class Exams., "Subjects"—Steam and Mechanical Engineering; "Grades"—Advanced and Honours; and compare them with the papers of the last exam. papers for first-class certificate of competency, and from the comparison he may get an idea of the standard of our engineering apprentices of the present day. Then about donkey men having certificates to qualify them to take charge of boilers. What does the chief's duties consist of; is he not the qualified man over everything in the engine-room department? The reason he had for suggesting qualified donkey men was the Hull affair some little time back. In reference to that we can each have our own opinion of the cause, and I told Mr. Leask mine at the meeting. I also told him the real cause of the present state of engineering, which was supply greater than the demand, and a sad want of loyalty man to man. I pointed out to Mr. Leask his restriction policy by exams., &c., that it won't do in these days of Free Trade. I also asked him what about the restriction policy which cost one society £42,500 at least, and gave the town a blow that it has not recovered from yet. Also where are these other two sea-going engineers' societies, are they still afloat, if so, will some of its members enlighten us as to benefits they have derived? Now, dear Editor, I have plenty more questions to put to Mr. Leask, but I must not be too greedy, and if you insert all this I will be under a great obligation to you. As regards your paper, I have taken it out since 1880, and I am highly satisfied with it. Thanking you in anticipation for inserting this,

I am, dear Sir,

PROGRESS.

34, Hotspur Street, Heaton West, Newcastle-on-Tyne,
Nov. 21*st*, 1887.

P.S.—I enclose my card—Mr. Leask will remember me; and for fear someone will think I am an outsider, I may say I am a chief engineer of five years' standing, but have no time to study navigation.

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—Your leaderette in last issue regarding the Marine Engineers' Union has been perused by me with considerable satisfaction, as it affords me an opportunity of endorsing your statement to the effect that many of its objects and some of its rules are not such as may recommend the movement to all parties who might otherwise countenance and assist it. This arises from the fact that some at least of the operations of the Union are intended to have the effect of bringing home to certain gentlemen, by the mild methods of moral suasion, a clearer sense of their duty towards the engineers in their employ, and of showing them that common humanity has certain claims upon them which have hitherto been overlooked. No one likes to have his shortcomings pointed out, even by an intimate acquaintance, although it has been said that "Friends unveil those faults that flatterers try to hide;" and we cannot reasonably expect that the aforesaid gentlemen would *at first* feel disposed to countenance and assist the Union, but as they are men of strong mental powers and shrewd business qualities, we feel assured they will eventually prove grateful to it for having, in a friendly way, pointed out to them an honourable means of escape from their present unenvious position; and we are perhaps not too sanguine when we express a hope that some of them may even yet be numbered amongst its best friends.

The policy of the Union is one of conciliation, not of aggression, and it intends to prove by its actions that while it will be ever

watchful over the welfare of engineers, it will be equally vigilant in protecting the interests of owners—keeping steadily in view the principle "That the interests of employer and employed are identical." Any statement to the contrary can only be made by those who wish to harm the Union, and I trust that any shipowner who may chance to read this will take note of it. Your caution as to aggressive measures is no doubt well meant, and we thank you for it, although, fortunately, it had already been acted upon, and we hope to be able to show that we possess sufficient common sense to steer clear of those quicksands which you trust we will avoid. I may add my official confirmation of your disclaimer as to being held personally responsible for the actions of the Union, as you will no doubt remember that during our first interview regarding it, I took the liberty of advising you not to take any personal part in the movement, as your doing so might endanger your reputation for impartiality which no one would regret more than myself; and I trust this will be sufficient to show your numerous readers who may not be marine engineers that you cannot be held responsible for the Union, which I can assure them is both able and willing to bear its own responsibilities.

I would like much to have a talk with Captain Thimm, R.N.R., who writes to us from the far away banks of the Irrawaddy, but as distance precludes the possibility of an interview, for the present, I can only ask him to favour me by perusing my previous letters, wherein he will find that only a small section of his profession is made the subject of criticism, and that our desire is to enlarge and strengthen those bonds of friendship that already connect the two professions. More than this we cannot say, as it depends as much upon one profession as the other to bring about that calm condition of peace and mutual esteem which ought to obtain on board every steamship in our mercantile marine.

It is matter of regret that your correspondent, Mr. T. W. Barron, was unable to be present at the opening of the Hartlepool Branch on 31st October, as he must have been gratified to find that his ideas and opinions had all been incorporated in the programme of the Union, and now that an opportunity has arisen in his own locality of carrying out these ideas, I feel assured he will give the local committee the full benefit of his advice and assistance whenever he may be able to do so, although he may not perhaps find it expedient to become a member.

No letter has lately appeared in your columns of greater excellence than that of "Eastern Mail Company's Engineer;" polished in style, faultless in logic, and portraying to the life the characters depicted, it ought to be read by every officer on board a steamship, whether on deck or below, and the lessons it inculcates taken deeply to heart by those for whose benefit they are intended. The cases he refers to are, I believe, exceptional, but that they *do* exist cannot be denied. However, the subject having now been ventilated, it is to be hoped that the good sense of those implicated may speedily lead to amendment, and that such conditions may soon be numbered with the things that were.

Your correspondent who signs his letter M.I.M.E. and A.I.N.A. has so unmistakably intended to give the Union a stab in the dark that I must decline to treat him as an honourable man until he publishes his name and address, which I hereby challenge him to do, when I will reply to his letter, if you will permit me, through the medium of your columns. He may plead as an excuse for not giving his name that my own letters are written under an official title; but that is no excuse at all, as my name and address are printed on every circular issued by the Union, of which 26,000 copies have already been distributed; and you are yourself aware, Sir, that my motive in writing under a title is to prevent any one having a pretext for saying that in advocating the cause of my brethren I am only trying to advertise my own business. This motive, I believe, is appreciated and respected by every member of the Union, and that is quite enough for me.

Although I decline to answer any of this correspondent's questions until he reveals his name, I may tell him he is not thanked for the cheap praise he attempts to bestow upon me at the end of his letter, as praise from some men is more irritating than blame from others. And I may further tell him that if he, either from shame or fear, does not give his name after this challenge, he must not blame marine engineers if they class him with those poor misguided creatures who shoot at landlords and others from behind hedges, or consign him and his letter to the limbo prepared by honest men for persons and productions that are alike beneath contempt.

The Hartlepool branch was opened successfully on 31st October, and its hon. secretary has secured very convenient premises for a club room in the same street as the post office, where he expects soon to have a large membership and every prospect of doing well; and upon Friday last I was present at the opening of the South Shields branch, the requisition for which was supported by upwards of 50 members, and the meeting was attended by a large number of engineers of all ranks, who took a deep interest in the proceedings. I was able to tell that meeting that no fewer than 150 members had joined in the past three weeks, bringing the number up to 964; and as I now write you, applications lie before me bringing the number up to 1,005, and the cry is still they come. With best thanks for your courtesy,

I remain, yours very truly,
THE HONORARY CHIEF SECRETARY,
Marine Engineers' Union.

91, Minories, London, 22*nd November*, 1887.

[We are surprised at Mr. Leask's treatment of "M.I.M.E.'s" letter. The questions asked were fair ones and should have been answered whether "M.I.M.E." chose to write, as is usually done, anonymously or not. Doubtless more will be heard from him in our next.—Ed. M. E.]

[For want of space we are obliged to leave over some correspondence.—Ed. M. E.]

Reviews.

Transactions of the Institution of Naval Architects, 1886. Edited by George Holmes, Esq., Secretary. London: Henry Sotheran and Co.

We now have before us the twenty-seventh volume of the transactions of the Institution of Naval Architects, and, without in any way wishing to detract from the value of its predecessors, we are of opinion that a more useful and thoroughly practical set of papers, both from the shipbuilder's and marine engineer's point of view, are not to be found in any other volume as yet published. In addition to what might be called the usual formal business transactions and announcements of the Institution, the present volume contains some nineteen papers, and forty-six sheets of illustrations. These papers, together with the discussions thereon and the accompanying diagrams, place in possession of readers, who may not have been able to attend the various meetings at which they were read, a fund of information unattainable from any other source, embracing, as they do, the views and opinions of some of the most able men of the day in the shipbuilding and marine engineering professions. It is noteworthy, as indicating the widespread influence of the Institution of Naval Architects, that two of the papers embraced in the present volume were contributed by eminent foreigners, namely, one by an old and gallant French officer, Admiral Paris, and the other by Monsieur M. Marchal. As the majority of the papers given in the volume have already appeared *in extenso* in our pages, we need not here make further reference to them; but we cannot close this cursory notice without saying, in common with all naval architects, how deeply we regret the fact that several of those who took part in the various discussions have, in the meantime, passed away from amongst us, never more to aid with their kind counsel or friendly criticism.

The Pattern Maker's Handy Book. By Paul N. Hasluck. London: Crosby Lockwood & Son.

Mr. Hasluck's present work is one of a very useful series, entitled "Handy Books for Handicrafts," and deals in a thoroughly practical manner with the whole subject of pattern-making. The book does not claim to be a pedantic treatise on an intricate art, but is intended rather as a handy book designed so as to be especially useful to the beginner, while at the same time it is hoped that the general information it contains, together with a copious glossary of technical terms, may make it handy even to practised hands of wide experience. The author deals with his subject under eleven headings, as follows:—Pattern Making; Moulding and Founding; Benches and Appliances; Hand Tools, Machine Tools; Turning, and Tools Used; Lathe Chucks; Core Boxes and Pillow Block Patterns; Circular Work; Miscellaneous Work; and Terms used in Moulding and Founding; and these, aided by upwards of one hundred illustrations, afford such information on pattern making and an insight into the processes to which the patterns are to be subsequently subjected as will enable any pattern-maker, be he amateur or skilled workman, to labour to the best advantage. Author and publisher are alike to be congratulated, the first for producing a good book, and the latter for bringing out the useful series of "Handy Books," of which the present volume forms one, at so reasonable a price.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from October 18th to November 17th, 1887.

14149 H. Jackson. Ships berths.
14166 A. G. Mumford & A. Anthony. Steam Engines.
14201 Bosshwedt (J. Cazeneuve). Non-conducting composition for boilers, &c.
14209 W. H. Rusden. Preventing corrosion, &c., in boilers.
14219 L. F. Pile. Stop valves.
14228 W. F. Pamphlett. Evaporating and condensing apparatus.
14233 D. Thomson. Circulation and supply of water to steam boilers.
14309 W. Fieldhouse. Ship's steering footboard.
14359 C. C. S. Knap. Water circulator for boilers.
14385 T. Downie. Packing for pistons.
14400 J. Sherman. Screw propeller.
14413 J. C. Jopling. Fuel economiser for furnaces.
14419 W. G. Robinson. Haulage hook or clip.
14447 H. N. Morgan. Torpedo.
14466 S. Douglas. Propelling vessels.
14495 F. W. P. Bouverie. Signalling at sea.
14532 M. Gledhill. Manufacture of tubes for boilers.
14533 M. Gledhill. Cranks, crank-shafts, &c., partly applicable for securing propellers to their shafts.
14634 M. Gledhill. Manufacture of steam boilers.
14574 J. Kirkman. Steam engine packing.
14601 T. R. Douse. Subduing fire on ships, &c.
14603 J. McGregor. Compound marine steam engines.
14605 J. F. Lefort. Movable float water wheels.
14659 J. McCallum. Ship's ladders.
14660 W. K. Couper. Launching ships' boats.
14664 J. H. Bell & Wm. Rockliffe. Shipbuilding plates.
14669 W. Brierley. Lubricator for engines.
14741 J. H. Amour. Ship's log.
14742 J. H. Amour. Ship's steering gear.
14747 G. Dawkins. Propulsion of boats.
14755 J. Lewthwaite. Breakwaters, groins, &c.
14767 T. D. Lambert & J. Colling. Transporting cleat for steam and other ship use.
14782 D. McGregor, Junr. Mariner's compass.
14783 J. C. Dobbie. Mariner's compass.
14828 J. Wing. Expelling water from leaky vessels, &c.
14835 J. E. Tyler. Torpedo boat.
14846 J. R. Lucas. Adjustable bearings.
14854 W. J. Gell. Covers for ships' boats.
14880 F. Buschmann. Lubricators.
14887 D. Campbell. Ships' yards.
14902 J. Barr and W. McWhirter. Automatic water level indicator.
14907 B. Dadley. Preventing racing in marine engines.
14924 E. E. Wigzell. Recording variations of speeds of engines.
14934 J. Thompson. Obtaining motive power.
14942 G. G. M. Hardingham. Mounting and working sailing vessels' centre board.
14966 J. Ford, W. J. Cox & E. Ford. Anchors.
14989 H. Stanning. Disengaging hook, ship's
15005 P. Mitchell. Manhole covers for tanks.
15019 J. Rushworth. Bending ships' plates.
15034 C. F. Amos & H. W. R. Smith. Steering gear connections.
15055 A. Vogelsang. Screw propeller.
15460 S. W. Allen. Shipment of coal.
15077 R. Chambers & W. Liddell. Life boats.
15114 Sonnenthal (E. Sonnenthal). Pile drivers.
15137 S. Butler. Staiths for shipment of coal.
15251 C. Sperry. Indicating speed of vessel.
15351 T. Elcoate. Removing steam boiler or other tubes.
15354 D. Cowan & A. Robertson. Ships' ventilators.
15365 W. E. Kochs. Loading vessels.
15390 D. S. McDonald. Keeping ships afloat.
15462 J. M. Lovold. Deck seats.
15523 H. S. S. Copland & J. C. Gilmour. Promenade and landing piers.
15591 L. Sirieix. Ships' compasses.
15594 W. Shapton. Steering apparatus.
15715 T. Brétèché. Ships' side lights.
15719 E. Wells. Water gauges.
15724 W. Shapton. Hydraulic capstans.
15740 G. Chapman. Steam ship propulsion.
15786 E. Pombas. Utilising force of water current to propel boats.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class 2 C, Second Class.

October 22nd, 1887.

Angus, Robt. ..	2C	Glasgow
Binson, John T.	1C	N.Shields
Blackburn, G. H.	2C	,,
Bolds, H. P.	1C	Cardiff
Bonniwell, P. O.	1C	London
Cliff, Wm.......	1C	Cardiff
Connor, Joseph..	2C	N.Shields
Dean, Edward ..	1C	N.Shields
De Winter, R. C.	1C	Liverpool
Fleming, Thos...	1C	,,
Foulds, Robt. ..	2C	,,
Forbes, D. Whyte	1C	Dundee
Gill, Richard....	2C	Cardiff
Henderson, John	1C	Glasgow
Higgins, John ..	1C	,,
Hodgson, Robt...	1C	W.H'pool
Horsfal, E. R...	2C	Liverpool
Jacobs, Geo. B...	2C	,,
Keeys, Edward..	1C	W.H'pool
Kelly, Wm. J. ..	2C	Liverpool
Lamb, Wm. H...	2C	N.Shields
MacDonald, D...	1C	Glasgow
McMecsis, Thos.	1C	London
McMeiken, James	1C	Glasgow
McMillan, Daniel	2C	,,
McMutrie, Thos.	1C	,,
Meek, Leslie	1C	Cardiff
Morgan, F.	2C	W.H'pool
Nicholson, Robt.	2C	London
Orr, John Wm...	2C	N.Shields
Pattison, James..	1C	W.H'pool
Pearson, W. G...	2C	N.Shields
Ramsay, Wm. ..	1C	London
Rendie, Robert..	1C	Glasgow
Sandie, David ..	2C	,,
Wait, Walter J...	2C	Cardiff
Wilson, James ..	2C	,,

October 29th, 1887.

Adams, John G.	2C	Liverpool
Carmichael, Jas.	1C	N. Shields
Gordon, Edwd...	2C	Belfast
Granger, Geo. ..	1C	London
Hall, E. John ..	1C	Sunderl'd
Hounam, Wm...	1C	,,
Hudson, Step. L.	1C	,,
Humphreys, J. B.	2C	Liverpool
Huson, J. W. ..	2C	Hull
Hyam, Richd. G.	1C	Southpt'n
Jensen, Fred. T.	2C	London
Mehaffey, Robert	2C	Belfast
Murchie, John ..	1C	London
Murchison, Chas.	2C	Southpt'n
Ogilvie, Geo. W.	2C	Liverpool
Palmgren, H. F.	1C	Hull
Scott, Alexander	1C	Glasgow
Sinclair, Wm. J.	1C	Aberdeen
Sweeney, Wm...	2C	Belfast
Taylor, Wm. H.	2C	Liverpool
Watson, A. R. ..	2C	Sunderl'd
Wigham, Wm...	1C	N.Shields
Williams, John..	2C	Liverpool

November 5th, 1887.

Blair, James	2C	Glasgow
Bradley, John ..	1C	Dublin
Brown, William	1C	Glasgow
Campbell, Colin..	1C	N.Shields
Campbell, J.	2C	Greenock
Cooper, Thomas..	2C	Leith
Crowe, Henry C.	2C	London
Dinwiddie, John	2C	Liverpool
Drysdale, John R.	1C	Leith
Earsman, Walter	1C	Leith
Elliott, Lawrence	2C	,,
Fearon, R. J. T.	1C	,,
Fletcher, Frank..	1C	Liverpool
Gibson, John....	1C	Glasgow
Grant, Alex. M.	1C	,,
Haley, Alfred ..	2C	N.Shields
Hendry, Malcolm	2C	Glasgow
Houston, John J.	2C	Liverpool
Hughes, P. L. ..	2C	London
Jones, Hugh....	1C	Dublin
Laird, Charles ..	2C	Glasgow
Martin, Andrew.	2C	,,
Mason, Thomas..	1C	London
McArthur, Wm.	2C	Leith
McDougall, Arch.	2C	Glasgow
McKay, John ..	1C	N.Shields
Olsen, Louis	2C	Leith
Pollock, W. J. ..	2C	London
Ramage, Chas. T.	1C	Greenock
Rayner, F. W...	2C	Liverpool
Rees, William ..	2C	London
Roscoe, William	2C	Liverpool
Scott, W. M.....	2C	London
Stewart, Alex. J.	1C	Leith
Whiteford, Robt.	1C	Bristol

November 12th, 1887.

Afflick, Robert ..	1C	London
Akhurst, Wm. G.	1C	,,
Buckmaster, H. G.	1C	,,
Harrison, John W.	2C	Liverpool
Hobson, George	1C	Leith
Holt, Charles T.	1C	Liverpool
Houfton, Chas. A.	2C	Hull
Hughes, F. W...	2C	Liverpool
Irvine, Matt. B.	1C	N.Shields
Justice, David ..	1C	London
Kirkland, Chas. F.	1C	,,
McPhail, Peter..	1C	Dundee
Miles, Vincent A.	2C	N.Shields
Morton, John ..	1C	London
Prest, Charles S.	1C	Hull
Randal, Rich. E.	2C	Dundee
Sivewright, David	2C	,,
Todd, William ..	1C	,,
Twentyman, R. G.	1C	N.Shields
White, G. Adam	2C	London
Wood, James F.	2C	Liverpool

November 19th, 1887.

Ashton, Richd...	1C	Liverpool
Atkinson, Wm...	2C	,,
Cunningham, R.	1C	Glasgow
Frederick, John..	2C	Cardiff
Fullerton, Charles	2C	Liverpool
Gifford, Robert..	2C	N.Shields
Grant, Daniel ..	2C	Glasgow
Hobkirk, G. C...	1C	N.Shields
Hoy, Henry O.	2C	W.H'pool
Hutchinson, T. H.	2C	,,
Lawson, John ..	1C	Glasgow
Mather, Joseph..	2C	N.Shields
Moverley, Robert	1C	Cardiff
Pratton, Thomas	2C	N.Shields
Rennie, Hugh ..	1C	Glasgow
Richmond, James	2C	Liverpool
Smith, David....	2C	N.Shields
Smith, John W...	1C	,,
Smwithwaite, J.	1C	W.H'pool
Taylor, Alfred J.	2C	Cardiff
Walter, W. J. ..	1C	Glasgow
White, George ..	2C	,,

The Marine Engineer.
LONDON, JANUARY 1, 1888.

EDITORIAL NOTES.

WE have been favoured with a long communication from Admiral Sir Thomas Symonds, expressing his views as to the condition of the British navy, which views are very far from expressing satisfaction with its present condition. He takes the view that so far from our large mercantile marine proving a naval reserve of any value, the absolute necessity for food supplies existing in this country would absolutely require help rather than be in any position to offer it. The protection of this marine to supply us with mere food is a great tax upon our navy, which would therefore be scarcely free to manœuvre in efficient fleets. Admiral Symonds goes so far as emphatically to state his opinion that our fleet should be not only stronger than the fleet of any other country, but should be even superior to any combination of three or four adverse fleets. The combination of only two well-known naval powers would make twenty-five heavily armed ironclads as against fifteen which we might be able to bring against them. Admiral Symonds considers that we need £20,000,000 at the very least, for a reserve of fifteen armourclads of the best power, to give us equal strength to a combination of only two hostile naval powers, and to enable us to keep one first-class fleet at sea with another ready coaled to relieve it. It appears, also, from Admiral Symonds' statement, that a very large number of our ironclads, supposed to be efficient, require great engine alterations, and that some of the new cruisers should be cut in two and lengthened, so as to raise the armour, or the armour should be taken off and replaced where necessary. All muzzle guns should be immediately replaced by breechloaders, as it is a matter of doubt whether muzzle guns could be reloaded within range of machine gun fire. It is apparent that in 1870 England's navy was greatly in preponderance to that of France, both in numbers and in method of construction; and it is undoubted, in Admiral Symonds' mind, that our preponderance is now materially weakened. It is thought by our correspondent that the power of the ram is jeopardised in many of our first-class ironclads by being at the end of unarmoured structures, It is thus unprotected from gun fire when out of waters while the French vessels are protected by their rams being covered with armour which is worked into them. It is probable that the ram may prove a most terrible weapon in serious warfare; and it should be protected in every possible way, so as to give it the greatest strength and best protection against gun fire. It seems, also, that the Admiralty build on the very rash basis of setting a considerable number of vessels in hand altogether of a type, before that type has been experimented upon, and thus many mistakes are perpetuated which, with more experience, might have been avoided. Our coaling stations are admitted to have long been a weak point in our system of naval defence. They are at present practically unprotected; and it is difficult to see how, during a war, they can either be protected without absorbing the fleet in their defence, or how they are to be coaled in time of war without absorbing most of our fleet to protect the communications. There seems to be a shrinking on the part of the Admiralty from carrying out experiments to settle, as far as possible, many of the debatable points in modern ironclad construction; and taking it all round, it seems that there is a very great deal that might still be done to put our fleet and Admiralty administration on a better footing.

As compared with our disparagement of our own navy and the doings of the Admiralty, we find much to interest us in the report just issued by Mr. Melville, Chief of the Bureau of Steam Engineering of the United States, as to the serious blunders made on that side of the Atlantic. Mr. Melville is very outspoken, and does not seem at all favourably impressed with the system of makeshift adopted by the United States Bureau. He specifies as examples of their penny wise and pound foolish system that when the old engines were taken out of the *Kearsarge* as unfit for further service, it was not thought worth while to build new engines for her, and consequently those taken years ago out of the *Nantasket* have been put into her. These engines are admittedly too small for her, but were the best that could be put in under the circumstances. The boilers were made up by borrowing two each from two other vessels, and the deficiency in these latter was made up by using forced draught. There seems, also, to be the same invidious distinction between similar grades in the relative ranks of naval officers and engineers, particularly among the cadets; and the *personnel* of the engineering staff seems to be reduced to limits which materially impair its usefulness. Apparently, the naval officers have complete control over the engineers, even to the arrangement of watches, and it seems the latter have frequently good ground for complaint for arbitrary and unnecessary taxes upon their patience on the part of the naval officers. It appears, also, that the allotments of men in the engineering department with different vessels

is as irregular and unsatisfactory as with us at home, the proportion of engineers being frequently in direct opposition to the relative size of the engines or difficulty attending their oversight and repair. The report states, also, that the firemen are often withdrawn from their duty below, and exercised in the manipulation of the spars and sails. How the boilers get on without proper attention as to fuel and water it is difficult to see, under these circumstances. Not long ago the chief engineer had to complain that he was unable to do the necessary overhauling and repairs, as his men were taken away for drills. This is in direct contradiction to the elementary principle of subdivision of labour, where each individual should attend wholly and solely to his own department. Coal trimmers should be considered an essential item to the engineer's force. We think this pictures a state of affairs very much worse than the present condition of our navy, though very like the condition there fifteen or twenty years ago, when much agitation was set on foot against these irregularities. The United States service does not seem to be attractive to engine room artificers. The good mechanics who can earn good wages on shore seem to much prefer that to life at sea when subjected to all sorts of drudgery and discipline outside their own department. The United States navy should recognize that a skilled artisan is more difficult to get and to keep than the ordinary seaman. There seems to be too much division into departments, without harmonious control by a single head. It seems that there is so much doubt as to the efficiency of the United States cruisers that they are seldom, if ever, run at full power; and it is an open question whether they could do it if required, or whether they would not break down under such a strain.

Some excitement has been caused at Southampton by exhaustive tests of the Nordenfelt submarine torpedo boat, which have been taking place in Southampton water and in the docks. A large number of naval attachés and scientific experts were present to witness the operations. It seems likely that the introduction of practicable torpedo boats, which are capable of being submerged at will and of delivering their attack under water, must tend to become so great a scourge to a blockading squadron as to entirely revolutionise naval tactics. It is difficult to see how blockading squadrons dare remain during the night exposed to the unseen attacks of such an invidious foe; and under these circumstances the blockading of a hostile port would be limited to all that could be effected in a sudden surprise in broad daylight. For the easy defence of ports such as the British ports, which are comparatively undefended by heavy batteries, the value of submarine torpedo boats would appear to be inestimable. There is still, however, probably much to be done in the way of experiment and of practical experience with a submarine boat before it can be relied upon as a trustworthy fighting machine; but the experiments that have just taken place with the Nordenfelt have sufficiently shown that she comes so near to a practicable and favourable result that only experience and ingenuity is required to perfect and do all that may be required. As we have mentioned in former issues, the peculiarity of the Nordenfelt system is that her buoyancy is overcome by mechanical means, so that in case of failure of any part of the mechanism she always tends to float. The Nordenfelt boat is driven by an ordinary marine engine of about 1,000 H.P., and has now attained a speed of 17 knots an hour, which is a great improvement on the first results achieved by the Nordenfelt boat.. When submerged, motive power is derived from the large reserve of latent heat stored up in a special boiler at a very high temperature. The cubic space filled with air within the vessel provides for the crew to breathe freely, even though submerged for several hours, and some 27 tons of water ballast may be discharged in a few minutes, should any mishap occur. The captain stands in a conning turret, with his head thrust into a glass cupola no bigger than a diver's helmet, and in the fore cabin with him he has always two assistants; the rest of the crew carry on their duties without knowing whether the boat is on the surface or submerged, and he communicates with them by means of speaking tubes. Her seagoing qualities have been thoroughly tested by Captain Garrett, who, with a crew of eight men, kept to sea in her for six days in a severe gale off the Land's End. She can carry sufficient coal for a run of about 1,000 miles, at an average of 8 knots an hour; but as her business will chiefly be in home waters, no long run is likely to be expected of her. The method of attack was very perfectly illustrated in Southampton water. The boat, with nothing but the conning tower and funnel showing above the water, went at speed towards a supposed enemy. After dark sharp watch was kept for the direction of the approach of the torpedo boat. The boat slipt past the vessel occupied by the observers on the slack tide without being seen, in spite of the greatest watchfulness, and then came back, dived and rose again within 400 yards of the vessel occupied by the visitors, the first indication of its approach having been the blast of the whistle, which was arranged should be given when the boat was within striking distance. Again the boat dived, and rose suddenly at a distance of 100

yards, without her path having been marked in any way. She drifted slowly past, then sank again and disappeared from sight, until, by a whistle in the distance, she indicated that she had passed out of sight and reach. A few minor faults were naturally noticeable during the course of the experiment, but they were such as could be easily amended by slight modifications; and altogether the general principles of her construction were highly approved by the experienced naval experts and visitors who were present.

There will shortly be put into the water two vessels, to be named respectively the *City of New York* and the *City of Paris*, now building by Messrs. Thomson, of Clydebank, for the Inman and International Company, of Liverpool, and which will mark a distinct step in advance in the annals of naval architecture and marine engineering. A deal of reticence has been displayed by builders and owners alike in regard to any particulars of these vessels, and it is, therefore, with pleasure that we are enabled to lay before our readers a brief *résumé* of their leading dimensions, and the chief points in their construction. Recognizing at the outset that though speed is now the great *desideratum* with passengers, safety and comfort are also equally important factors in Atlantic liners, owners and builders alike have striven to combine the three qualifications in these vessels. The new vessels, which will have a length on the water-line of 525 ft., or over-all of 560 ft., with a beam of 63½ ft., and a moulded depth of 42 ft., will be minutely subdivided, the divisions being so arranged that no bulkhead in the ship shall have a door below the level of the upper deck. In this way the utmost benefits of minute subdivision is ensured, for if in any emergency, such as happened to the *Oregon*, the safety of the ship depends upon the shutting of water-tight doors, the safety may vanish just at the critical moment, whereas with these vessels there are no doors to shut, hence the factor of safety is a constant one, and not, as is too often the case, a *minus* quantity. The vessels will have a tonnage of 10,000 gross, and be provided with four complete decks, promenade, upper, main and lower, with partial deck above promenade deck, and partial deck below the lower deck. The number of complete transverse water-tight bulkheads, all of which are without doors, is 14, so that the average length of each compartment is 35 ft., or a little more than half the breadth of the vessel. The subdivision is such that the vessels will remain perfectly seaworthy with any two, or even three, compartments flooded, a great advantage over any passenger vessel hereto constructed, few, if any, of which would stand the breaching of two compartments. To minimise the danger which might result from a breakdown of machinery, twin screws and engines are provided. The two sets of engines are placed in two separate compartments, subdivided by a water-tight bulkhead, while the boilers are in three separate compartments, completely cut off from each other. From this method of construction it will be seen that these vessels might be in collision and be struck on any bulkhead, and simultaneously have a breakdown of machinery such as would disable any ordinary ship, and they would be still quite navigable and thoroughly safe and seaworthy. With twin-screws the turning-power is greatly augmented, and to further ensure rapidity of steering the vessels are fitted with their builders' improved rudder, which has already given such remarkable results in the Spanish cruiser lately completed by them. Each vessel has a double bottom, holding 1,500 tons of water, by discharging which their draught may be considerably lightened, thus allowing them to pass the New York bar on any tide. Each is adopted for forced draught on the closed stokehold system, and to facilitate the rapid and noiseless handling of cargo and stores, the vessels are being fitted throughout by Messrs. Brown, of Edinburgh, with their patent hydraulic appliances, the steering gear and cables being also worked by hydraulics. The vessels will have three masts and three funnels, and to provide against rolling they will be fitted with rolling chambers similar in character, though much improved in form, to those fitted in some of the large warships. *En passant*, it will be comforting to those travellers who suffer from *mal de mer* to know that the builders of these splendid vessels have, after a long series of experiments, and actual trials on the Atlantic, arrived at a form of chamber which will reduce the rolling by quite one-half. The main saloon, placed on the upper deck forward, will be arranged on the patent system of the builders, similar, though much larger, than that fitted in the *America*. The vessels have been arranged to act as armed cruisers, the whole of the steering gear being placed below the water-line as in the regular warship. These vessels mark a new departure in Atlantic liners, and will, we trust, prove to be the forerunners of even further improvements, and owners and builders are alike deserving of congratulation for their efforts to make them as safe as it is possible to make them, and as comfortable and convenient as human ingenuity can devise.

*** The continuation of the article upon the "Progress and Development of the Marine Engine" is unavoidably crowded out of our present issue.

SHIPBUILDING AND ENGINEERING DURING 1887.

THE MERSEY.

It is to be regretted that the returns of the past year's work in the shipbuilding yards of the Mersey show a marked declension as compared with both the years 1886 and 1885, when the depression in the shipbuilding and engineering industries now passing away reached its deepest depths. It is scarcely within our province to allude to the causes of such declensions in local shipbuilding, but they can scarcely pass unnoticed. Surely the Mersey is not in a worse position than Belfast for the delivery of material. Why is it, then, that in the one case shipbuilding prospers and in the other it declines? It is not to be expected that only one cause produces such a result—although the principal one is, we anticipate, the proportionally heavy cost of labour on the Mersey. Both in shipbuilding and engineering repair work is the staple department, and somehow in that branch piece-work is at a discount; and speaking from experience, we believe the result is, that on the Mersey the class of labour available, especially in the shipbuilding and boiler making department, is not of the highest order. When heavy repair work is on hand any workman can find employment, and as piece-work is rarely resorted to, there is no encouragement to the best and most active workmen. A want of adaptation to the times probably assists to account for the declension of shipbuilding on the Mersey. It is no secret that an important order for one of the largest Atlantic mail steamers now building had to be given up, by a prominent shipbuilding and engineering firm, on account of the want of facilities for its construction. If our shipbuilding friends on the Mersey do not rouse themselves to action, and find a means of reducing the cost of production, both by paying less for labour, and by increasingly using the latest mechanical contrivances, we fear it will not be the last time that we shall have to chronicle a decreased output from their establishments.

Messrs. Laird Bros., Birkenhead, had a variety of work, and, as is not uncommon in their experience, a number of the craft turned out by this firm consisted of small vessels to be shipped for foreign ports. As, however, in each instance they were provided by the builders with engines, the six vessels, whose combined tonnage was only 760 tons, afforded a considerable amount of work. The largest vessel turned out during the year was the new cattle steamer *Olga*, for the London and North-Western Railway Company, fitted with twin-screws, each driven by a set of triple-expansion engines. This vessel, and all those built by this Birkenhead firm, were constructed of steel, and in the *Olga* the stern and rudder posts were of cast steel by Messrs. Jessop & Sons, Sheffield.

The *Esperanza* and the *Perseverança* were also two notable twin-screw steamers built during the past year, being respectively the fifteenth and the sixteenth vessels built by Messrs. Laird Bros., for the Amazon Steam Navigation Company. These vessels had a novel appearance on the water, as although screw steamers they are fitted with sponsons. On their trial trips the engines of these vessels indicated 750 H.P., a mean speed of 12·5 knots being attained. As usual, Messrs. Laird Bros. have had a large amount of overhauling and repairing work, and the event of the year in this department was the re-engining and boilering of the well-known mail steamer *City of Berlin*, of the Inman and International Line. The new engines are driven at 65 revolutions, and indicate 5,000 H.P. Besides being thoroughly overhauled, the passenger accommodation was increased and improved, and Kilburn's patent system of refrigerating meat, &c., fitted up. The prospects of this firm for the year 1888 appear to be brighter, as amongst the vessels in process of construction is one of about 7,000 tons register, fitted with twin-screws, for a new service between Hamburg and New York.

Messrs. W. H. Potter & Son, Liverpool, built four steam vessels during the year, two of which were for local owners. Possibly the most notable steamer launched by this firm was the s.s. *Taal*, having triple-expansion engines and fitted with a shade deck for three-fourths of her length, to suit the passenger traffic of the Philippine Islands.

Messrs. R. & J. Evans & Co., of the Brunswick Dock, besides the large iron sailing ship *Metropolis*, of 1,810 tons, built an iron twin-screw steamer for the Mersey Docks and Harbour Board, designed for the purpose of assisting the berthing of vessels in the docks, and fitted up with a steam fire engine.

Messrs. Thomas Royden & Sons built the two iron sailing vessels *Maxwell* and *Balmoral*, the latter being no less than 2,092 tons register, and besides constructed four barges of steel.

The Canada Works Shipbuilding and Engineering Company also had a fair share of work, launching in February two experimental refuse hopper barges for the Liverpool Corporation, viz., the *Alpha* and *Beta*. Subsequently they received the order for four barges of similar construction for the Corporation, 72 ft. long, 15 ft. 9 in. breadth, 3 ft. 10 in. loaded draught.

Messrs. John Jones & Son, of the Brunswick Dock, launched two steamers, one of more than average deadweight carrying capacity, viz., the steel s.s. *Bencroy*. The s.s. *Gwynfaen*, an iron screw steamer for local trading, was also amongst the vessels launched during the year.

Mr. William Dickinson's, of Birkenhead, most notable turn out was a twin-screw gunboat built to the order of the Crown Agents for the Colonies, for service at Lagos.

Amongst the vessels built by Messrs. Cochran & Co., Birkenhead, the *Pedro de Castille* built for towing coal lighters at the Grand Canary Company's Wharf at Las Palmas, and a twin-screw steamer for navigating shallow rivers on the West Coast of Africa were first-class specimens of the high-class work executed by this firm, so well known for their patent vertical multitubular boilers, for which during the year that has closed there has been a large demand.

Messrs. J. F. Waddington & Co., of Seacombe, appear to have been amongst the fortunate firms. By the beginning of July they had launched eleven vessels. A good specimen of the dispatch that this firm can give was instanced in the building of the twin-screw steamer *Firefly*, built for the Liverpool and New Ferry traffic. The vessel, although of considerable size, was launched within two months of the order being booked. The s.s. *Furao*, s.s. *Olinda*, and s.s. *Ariel* were among some of the notable craft built by this deservedly well-known firm during the year.

Messrs. David Rollo & Sons appear to have been one of the most fortunate firms in the engineering and boilermaking department, as distinct from shipbuilding, having re-engined or converted compound engines into triple-expansions, and fitted new boilers to a large number of steamers, although Messrs. Fawcet, Preston & Co. also secured a share of this class of work. Ordinary repairing of hulls, engines and boilers has also contributed a considerable *quota* of work during the year, but in addition to hearing that the Mersey was a more active shipbuilding centre, we would also be glad to find that a way had been found whereby the cost of repairs and overhauling had been brought down to at any rate something like North-East Coast prices.

THE CLYDE AND SCOTLAND.

The long felt depression in the Clyde shipbuilding and engineering trade, in common with that experienced elsewhere, has for some months given decided token of passing away, and this assurance makes it more pleasant to look back upon the limited amount of work done during the past year. We may at once give a summary of that work, not only as concerned with the Clyde, but in connection with the other shipbuilding districts of Scotland, as well as comparing the work for the year with that of four previous years.

	1887.	1886.	1885.	1884.	1883.
Clyde	185,362	172,440	193,453	206,854	419,664
Dundee	14,245	3,347	7,358	12,071	25,276
Leith	4,167	5,340	7,759	5,000	13,722
Aberdeen ..	1,842	1,550	6,246	7,626	11,628
Grangemouth ..	1,730	2,627	1,153	1,565	4,332
Kirkcaldy ..	1,920	—	—	—	—

The Clyde output of 185,362 tons is made up of 326 vessels 203 being steamers of 147,537 tons, and 123 sailing ships of 37,525 tons. Last year the output was 172,440 tons, representing 166 vessels, so that the increase in favour of the present year is 12,922 tons, but as compared with 1885 there is a decrease of about 8,000 tons. Of the vessels, 194 aggregating 148,569 tons were constructed of steel; 46 representing 36,286 tons of iron, and 86 with a tonnage of 507, of wood. The vessels built of steel are about 80 per cent. of the total, whereas, last year steel

was only represented to the extent of 68½ per cent., and the year previous 48 per cent. Marine engines were constructed during the year to the number of 159, both by shipbuilders and marine engineers, representing an I.H.P. of 198,992. Of these 63, and a tonnage of 134,120, were on the triple-expansion principle, several were quadruple-expansion engines, and a large number, specially for paddle boats, on the compound principle. There is at the present time shipbuilding work on hand aggregating 206,041 tons. This is 75,765 tons more than in July, 1887, and 88,366 more than in December, 1886.

The following is a tabulated statement of the output of steam and sailing vessels produced by the several Clyde firms. The H.P. of engines given, however, only represents that where the builders of the hull were also the engineers. A separate statement of the engines made by engineers who are not themselves builders will be added.

	Total No. of vessels.	Tonnage of sailing ships.	Tonnage of steamers.	Total tonnage.	H.P. of engines.
Messrs. Russell & Co...	15	17,452	9,583	27,035	—
A. Stephen & Son ..	10	4,031	18,884	22,915	10,750
D.&W. Henderson & Co.	7	117	14,299	14,416	7,200
Fairfield Company ..	6	—	13,228	13,228	40,640
Caird & Co.	2	—	12,525	12,525	14,000
W. Denny & Bros. ..	8	—	10,369	10,369	10,050
R. Napier & Sons ..	3	—	9,850	9,850	13,450
Lobnitz & Co... ..	27	—	9,600	9,600	7,445
J. & G. Thomson ..	3	—	8,200	8,200	26,600
C. Connell & Co. ..	4	3,348	4,492	7,840	—
R. Duncan & Co. ..	4	3,688	3,975	7,653	—
A. M'Millan & Son ..	5	—	6,300	6,300	—
Barclay, Curle & Co. ..	3	4,470	—	4,470	—
A. & J. Inglis	4	—	4 615	4,615	8,360
London & Glasgow Co.	1	—	3,450	3,450	3,550
Aitken & Mansell ..	1	—	2,770	2,770	—
J. Reid & Co.	5	2,000	2,920	4,920	—
Scott & Co., Greenock..	3	—	2,000	2,000	—
Alley & M'Lellan ..	22	—	1,945	1,945	—
Birrell, Stenhouse & Co.	1	1,734	—	1,734	—
Napier, Shanks & Bell	4	—	1,680	1,680	—
W. Simons & Co. ..	3	—	1,550	1,550	1,670
Blackwood & Gordon..	2	—	1,000	1,000	—
D. J. Dunlop & Co. ..	6	70	654	724	1,110
Murray Bros.	3	—	620	620	—
James M'Arthur & Co.	2	—	580	580	—
John Fullarton & Co...	7	80	480	560	—
S. M'Knight & Co. ..	2	—	399	399	—
Abercorn & Co. ..	5	—	376	376	—
Fleming & Ferguson ..	1	—	250	250	350
Mechan & Sons ..	47	—	245	245	—
William Fyfe & Son ..	5	195	—	195	—
W. S. Cumming ..	13	225	136	361	195
D. MacGill & Co. ..	2	—	187	187	—
Scott & Co., Bowling..	2	—	168	168	—
Ailsa Company ..	3	80	42	122	75
T. B. Seath & Co. ..	1	120	—	120	—
T. Orr, Junr.	Several	115	—	115	—
Messrs. David White and Co.	70	100	—	100	—
J. & J. Hay	1	—	80	80	15
Ross & Duncan ..	2	—	50	50	—
Murdoch & Murray ..	1	—	20	20	—
John Thomson.. ..	1	—	15	15	—
Totals	326	37,825	147,537	185,362	145,450

Several firms did no new work during the year, amongst them being the Cambeltown Company, the Culzean Company, the Ardrossan Company, Messrs. W. Hamilton & Co., Port-Glasgow, W. Swan & Co., Maryhill.

As indicated by the general abstract, 82 engines, aggregating 145,450 I.H.P. have been constructed by shipbuilding firms on the river during the year, but a large number of engines are yearly made by firms who do not themselves build ships. Indeed, many of the engineering firms booked orders for both hull and engines, and sub-contracted for the former. This is a practice which is becoming more common. Such engineering establishments have turned out during the twelve months, 77 engines, totalling 52,470 I.H.P., which makes the complete number of engines built on the Clyde 159, giving an aggregate of 198,020 I.H.P. No vessel that was launched on the Clyde during the year, left the river without her engines, but, on the other hand, several new steamers were towed into the Clyde to have machinery placed on board, while in a few other cases the engines were forwarded. A number of steamers have also had compound engines replaced by those of the triple-expansion type. Engines for vessels not built on the Clyde made up 19,330 I.H.P. These included two engines of 4,700 I.H.P. for vessels built at Belfast, one of 9,000 I.H.P. for the *Aurora*, built at the Royal Dockyard at Pembroke, and one of 600 I.H.P. for a vessel built at Grangemouth. Of the total engines constructed, 63 representing 134,120 I.H.P. were of the triple-expansion type, leaving 96 of 64,800 I.H.P. on the quadruple-compound, high-pressure, and other principles. Compound engines for paddle steamers represented over 30,000 I.H.P. The following is the tabulated statement of the marine engines made by firms who did not themselves build the ships:—

	No. of Engines.	I.H.P.
Messrs. J. & J. Thomson, Glasgow	6 ..	10,200
,, D. Rowan & Son	5 ..	7,460
,, Jas. Howden & Co., Glasgow ..	4 ..	6,850
,, Rankine & Blackmore, Greenock..	4 ..	5,640
,, Muir & Houston, Glasgow	3 ..	4,450
,, Ross & Duncan, Govan	26 ..	4,375
,, Dunsmuir & Jackson, Govan ..	9 ..	3,950
,, Hutsen & Corbett, Glasgow.. ..	5 ..	3,600
,, Duncan Stewart & Co., Glasgow..	2 ..	2,450
,, Hanna, Donald & Wilson, Paisley	5 ..	1,155
,, Walker, Henderson & Co., Glasgow	2 ..	940
Mr. Wm. Kemp, Glasgow	2 ..	900
Messrs. Kincaid & Co., Greenock	3 ..	800
,, Wm. King & Co., Glasgow	1 ..	700
Totals	77	53,470

Few of the vessels built during the year have been very remarkable in point of size. The largest were the two Peninsula and Oriental steamers *Victoria* and *Britannia*, launched by Messrs. Caird & Co., Greenock. They were 6,268 and 6,267 tons respectively, and were supplied with triple-expansion engines of 7,000 I.H.P. Next in order comes the North German Lloyd's steamer *Lahn*, built by the Fairfield Company; the *Buenos Ayres*, 5,195 tons, constructed by Messrs. W. Denny & Bros., Dumbarton; H.M. belted *Galatea*, launched by Messrs. R. Napier & Sons, Govan; the Royal Spanish cruiser *Reina Regente*, of 5,000 tons, built by Messrs. J. & S. Thomson, Clydebank. The larger sailing ships were the *Drumcliff*, a four-masted ship of 2,525 tons; the *Sokoto*, a four-masted barque of 2,261 tons, both launched by Messrs. Russell & Co., Port-Glasgow; and the *County of Linlithgow*, a four-masted ship of 2,207 tons, built by Messrs. Barclay, Curle & Co. (Ltd.), Whiteinch. Of the vessels launched there were—

	1887.	1886.
Under 50 tons ..	187 ..	28
,, 100 ,, ..	18 ..	13
,, 500 ,, ..	46 ..	46
,, 1,000 ,, ..	10 ..	14
,, 1 500 ,, ..	16 ..	11
,, 2,000 ,, ..	16 ..	24
,, 2,500 ,, ..	11 ..	20
,, 3,000 ,, ..	10 ..	2
,, 4,000 ,, ..	6 ..	2
Above 4,000 ,, ..	6 ..	6

The large increase in the vessels under 50 tons is partly accounted for by the inclusion of one or two firms who build small vessels; but apart from this there have been many more vessels of this class built during the year.

At Dundee the shipbuilding industry has greatly improved during the latter months of 1887, and there are at the present time more cheering prospects for the industry and all depending on it than at the close of 1886, which year was, without doubt, the worst and gloomiest ever experienced since shipbuilding began at the port. During the present year fifteen vessels, of an aggregate of 14,245 tons, have been launched, as compared with four vessels of an aggregate tonnage of 3,347 in 1886, being upwards of four times the tonnage built in the latter year, and the largest since 1876, with the exception of 1883, when the

aggregate was 25,276 tons. Messrs. Gourlay Brothers & Co. have launched four vessels—one being a steam yacht—of the aggregate tonnage of 5,531, and they have on hand a large vessel of 3,150 tons for Messrs. W. Thomson & Sons, Dundee. A good deal of work has also been turned out at the Caledon Shipbuilding Yard, belonging to Messrs. W. B. Thompson & Co., Limited. Seven steamers of the aggregate tonnage of 5,035 have been launched, including two trawlers and a powerful twin-screw steamer for towing purposes on the Hooghly. Three vessels of 2,326 tons have been launched from the yard of Messrs. Pearce Brothers. Messrs. A. Stephen & Sons have launched a steel barque of 1,353 tons, and they have on hand a four-masted steel ship of 1,976 tons gross. Though at present the Caledon and Craigie Yards have no orders on hand, numerous inquiries are being made. Of the vessels 10 have been of steel, of the aggregate tonnage of 9,429, and six of iron, of an aggregate tonnage of 5,566.

A very marked increase in marine engineering in Dundee has also taken place during the year. The Messrs. Gourlay have built four sets of 725 H.P. Messrs. W. B. Thompson & Co. have made 13 sets of 1,645 H.P., and the Messrs. Pearce have built three sets of 345 H.P. In all no fewer than 21 sets of engines have been made, of which eighteen were triple-expansion and three compound engines, representing 3,115 N.H.P., as compared with 10 sets of 832 H.P. in 1886.

At Leith matters have been exceedingly slack, and beyond the construction of a large river steamer for China the work executed has been of an unimportant character. The tonnage of vessels launched in 1885 was 7,759, in 1886 5,340, while in 1887 it only amounts to 4,167. Messrs. Ramage & Fergusson placed seven vessels in the water, the principal structure being the *Tatchau*, a twin-screw steamer of 2,260 tons gross register, being intended for the navigation of the Pearl River, China. All the other vessels produced by Messrs. Ramage & Fergusson were pleasure yachts, excepting a steamer of 500 tons named the *Chamrocu*, for trading in the East. The only vessel launched by the Messrs. Morton was the pleasure steamer *Tantallion Castle*, the latest addition to the Galloway Steam Packet Company's fleet. This firm at present, however, are engaged in reconstructing the interior of the London and Edinburgh Shipping Company's steamer *Marmion*, and when fitted with new engines and boilers she will, doubtless, prove one of the swiftest vessels in the company's service. The only other launches during the year have been a few fishing craft. In consequence of the dull state of trade there has been, as might naturally be expected, a great number of ship carpenters, moulders, boiler makers, &c., thrown out of work; but in the year to come matters are expected to be much brighter, and the ground for this hope lies in the number of orders which the shipbuilders have at present on hand for execution.

The Grangemouth Shipbuilding Company launched during the year seven vessels of 1,730 tons. Of these five were steamers aggregating 2,445 H.P. Last year they launched eight, of 2,627 tons, six being steamers with engines of 2,164 I.H.P.; and in 1886 they turned out seven vessels of 1,153 tons, three of them steamers with engines of a united I.H.P. of 1,320.

At Kirkcaldy, Messrs. John Scott & Co., Kinghorn, launched six steam vessels aggregating 1,920 tons, with engines of 5,250 I.H.P.

Shipbuilding at Aberdeen has by no means recovered the depression which set in in the year 1884, and which was most marked in the year 1886. There are three large shipbuilding yards in the town, but in 1886 the work done at them consisted of little more than repairing, only one vessel being launched. This year the yards have been somewhat more active, but the work has again been mostly of the nature of repairs, and though the number of vessels launched has been six, only two vessels of any size are included in the number, while one firm has not turned out anything. The two vessels referred to are; s.s. *St. Sunniva*, 1,000 tons, 200 H.P., built for North of Scotland and Orkney and Shetland Steam Navigation Company; s.s. *Oithona*, 750 tons, 125 H.P., built for Aberdeen Steam Navigation Company.

A MEMORIAL is to be addressed to the Government from certain towns on the coast, praying that electrical communication may be established between the Channel lightships and the shore. The necessity of some means of communication has been proved during the recent disasters in the Channel, thus the *W. A. Scholten* accident occurred within a very short distance of the Goodwin Sands lightship.

NORTH-EAST COAST.

In reviewing the shipbuilding of the North-East Coast, seeing that elsewhere complete records of the shipbuilding of 1887 are given, we shall mainly confine our remarks to comparisons of the work turned out at the various ports in the year that has closed with previous years. In 1881 the entire output of the shipbuilding yards of the United Kingdom was about 1,000,000 tons, in 1882 it was increased to 1,200,000 tons, 1883 witnessed a slightly greater output, about 1,250,000 tons; in 1884 there was a sudden and great falling off to 750,000 tons, an experience unfortunately repeated in 1886, when under 500,000 tons of shipping were launched. At the time of writing, the returns for the year just closed are not quite complete, but judging from individual ports, the year's operations have been somewhat greater, although in some instances decreased work has unfortunately been experienced.

At Blyth there was only one vessel launched, the steel screw steamer *Exeter City*, but as that vessel was 2,120 tons gross register, the result of the year's working compares favourably with that of the previous one—1886—when only a small sailing craft of 48 tons was built. The Blyth Shipbuilding Company, Limited, having secured a share of the orders recently given out, will no doubt have still better results to show at the termination of 1888.

The Tyne. Here, again, it is satisfactory to note that there has been an increased output as compared with the year immediately preceding. The total tonnage launched at seventeen yards in the year 1886 was 82,760 tons, consisting of three sailing vessels and sixty-four steamers. In the year just closed, 1887, from twelve shipbuilding yards, there has been an output of 100,051 tons, an increaseof 17,291 tons over 1886; practically all were steam vessels, the exception in the total of sixty-six being the composite lightship *Puffin*, built by Messrs. Schlesinger Davis and Co., Wallsend. The features of Tyne Shipbuilding in 1886 were the increased adoption of steel, 71½ per cent. of the total tonnage of that year being built of that modern material, as against 54½ per cent. in 1885. This feature has been fully maintained in 1887, as out of the sixty-six vessels built in that year only fourteen were of iron of the ordinary quality, and the bulk of these were of small tonnage, six being steam barges for Panama and Colon, and all being under 500 tons gross register except the s.s. *Rosario*, of 1,790 tons, and an iron screw steamer of 1,193 tons, built by Messrs. R. & W. Hawthorn, Leslie & Co., Hebburn.

As in the year 1886, Messrs. Sir Wm. Armstrong, Mitchell and Co., Limited, again head the list, the combined output of their Elswick and Walker yards amounting to 24,930 tons, an increase of 3,904 tons over the previous year. Unfortunately, the prospects for the Elswick yard are not at the present time very promising, although a large number of men are still employed on H.M.S. *Victoria*, the only vessel launched from Elswick during the past year. At the Walker yard there has, however, been constructed three steel twin-screw protected cruisers for the Chinese Government's revenue service, to steam 12½ knots, and engined with triple-expansion engines by the Wallsend Slipway and Engineering Company, Limited.

The *Drudge* was another special craft built during the past year, designed for the purpose of proceeding to sea with 110-ton guns when undergoing testing, and also to act as a barge. This vessel was also engined with triple-expansion engines by the Wallsend Slipway and Engineering Company, Limited, the cylinders being 12 in., 19 in., and 28 in. diameter, and 21 in. length of stroke. Several of the remaining vessels built by this Company were oil-in-bulk carriers, in every case for foreign owners.

Palmer's Shipbuilding and Iron Company, Limited, come next in order, having also launched 14 vessels, but of less tonnage, viz., 19,324 tons, a slight decrease as compared with 1886 of 1,401 tons. The decrease is, however, more apparent than real, as, during a large portion of the year, this company's workmen were engaged in completing the belted cruisers of Her Majesty's Navy, *Orlando* and *Undaunted*. Six of the vessels built at Jarrow were for the Panama Canal Company, four of them having twin-screw engines. We are pleased to hear that the prospects of this large and enterprising company are very promising in all departments. At present two additional furnaces are being erected at the Steel Works to meet the increased demand, and so successful has the company been in obtaining orders for their own shipbuilding yards, that they are practically out of the market for supplying steel-plates and angle-bars.

Messrs. C. S. Swan & Hunter, Wallsend, have, as will be seen from the tabulated statistics, turned out eight vessels, the majority of which are above the average size. This enterprising and successful firm are to be congratulated upon the high standard of work they turn out, embracing passenger steamers for the Australian Colonies, Denmark and Germany, as well as for English owners.

One of the most notable steamers built by the firm of Messrs. Swan & Hunter during the past year was the steamer *Courier*, which, although only 728 tons gross register, was provided with triple-expansion engines of the cruiser type, exerting on trial the enormous H.P. for such a small vessel of 3,000 I.H.P. As was anticipated, the guaranteed speed of 17 knots was largely exceeded, the mean result of the full speed trial being 21 miles per hour under forced draught. Unfortunately, we did not describe this vessel in our Newcastle Exhibition article, as at the time of compiling our notes, the model was not on the stand of Messrs. Swan & Hunter, but all those who were privileged to see it, and were able to form an opinion, must have acknowledged the design to be a perfect specimen of naval architecture. At the present time Messrs. Swan & Hunter's yards are fairly well employed, and we have no doubt that during the year 1888 they will turn out their full share of vessels. During the year that has just closed this firm launched eight steamers—all of steel—of 13,614 tons, with engines of 13,000 combined I.H.P.

Messrs. J. Readhead & Co., South Shields, have also been fairly fortunate in the amount of work got out of hand, six steel steamers of 13,614 tons having been launched in 1887 from their shipbuilding yard—all over 2,000 tons gross register. The whole of the berths are now occupied, five large steel steamers being in various stages of progress, and this firm is further credited with having sufficient orders on their books to keep their establishment in full swing during the whole of 1888.

Messrs. J. Wigham, Richardson & Co., Walker-on-Tyne, have not been so fortunate as some of their neighbours, their output consisting of only four steamers of 7,632 tons, with engines of the combined I.H.P. of 8,250 tons. They have at present two vessels on the stocks, one of which is said to be the largest steamer now building on the North-East Coast.

The Tyne Iron Shipbuilding Company, Limited, Wellington Quay, have only launched two steamers, of 4,944 tons, both of steel, the second one, the s.s. *Karnak*, having only been launched on the 14th December. Better things appear to be in store for this company, as it is understood there are several orders on their books.

Messrs. R. & W. Hawthorn, Leslie & Company's, Limited, total tonnage is 7 screw steamers of 10,575 tons and 10,200 I.H.P., all steel built but one; but as there are four vessels on the stocks, and one of them is nearly ready for launching, in this instance the actual figures may be somewhat deceptive of the work executed, more especially as this firm have been very extensively employed in their dry dock in repairing work, &c., three large foreign liners having been altered and entirely reconstructed by them with passenger accommodation, &c., and fitted with new boilers and engines, the latter of their improved triple-expansion type. They have, besides, been engaged in repairing several large vessels which had sustained heavy damage, this description of work being a special feature at Hebburn. The extensive forge department has also been fully employed.

Messrs. William Dobson & Co., Low Walker, have launched three steel steamers of 2,660 tons, not a bad result, seeing how ill-provided with work this yard was during the earlier months of the past year. There is no doubt that the year 1888 will witness increased briskness at this establishment, as at the present time there are four vessels on the stocks in various stages of progress.

Messrs. Wood, Skinner & Co., Bell Quay, who were very unfortunate in commencing business at the beginning of the late depression, have had a better year than any since their establishment started work, having launched four steam vessels of 2,338 tons, three being of steel and the fourth one of iron. At the present time there are two vessels on the stocks, and one lying afloat, and there is every prospect that 1888 will be a brighter year for Messrs. Wood, Skinner & Co. than 1887.

Messrs. Schlesinger, Davis & Co., Wallsend-on-Tyne, have only launched two vessels during the year, the composite lightship *Puffin* and the *Kate B. Jones*, of steel—2,163 tons in all. In this instance, also, we venture to predict a better return will be given for the year that has just now commenced.

Mr. Jos. T. Eltringham, of South Shields, has built three iron and one steel steamers of 490 tons; Messrs. T. & W. Smith, North Shields, an iron twin-screw steamer of 226 tons, and the Tyne General Ferry Company a steel steamer of 77 tons, for their own services.

The Wear. This well-known centre of shipbuilding has been among the most fortunate for the past year, if the term fortunate could be applied to any portion of the shipbuilding industry in 1887. Altogether, including the River Wear Commissioners' barge *Concrete*, and a steel pontoon for the Corporation Ferry, there have been 49 vessels of about 85,000 tons launched, an increase of over 28,000 tons as compared with the tonnage launched in 1886, and of over 23,000 as compared with the results of 1885. The shipbuilding on the Wear for 1887 also compares favourably with 1884, when 71 vessels, of 99,589 tons, were launched. The average size of vessels built at Sunderland in 1885 was 1,335 tons; in 1886 it had increased to 1,389 tons, but in the year now closed, including the small craft mentioned, the average tonnage of the vessels launched has reached 1,734 tons. As these figures also include a torpedo boat and a small barge for carrying ore, built by Mr. Jas. Laing for French owners, it is very apparent that there was a great increase in the size of the deadweight carrying steamer, the staple trade of the Wear. This tendency to build larger steamers for ordinary mercantile purposes is, we believe, on the increase; so much so, that for trades for which steamers of 3,000 tons deadweight and upwards are available, there is a feeling that freights will fall, while for light draught steamers of moderate size, profitable employment will not be wanting in 1888.

Messrs. Jos. L. Thompson, North Sands, have launched eleven steel steamers of 21,823 tons during the past year, an increase of 5,752 tons over the output of tonnage from their establishment in 1886. Amongst the number of vessels completed during the past year were the *Lancashire Witch*, for the new Isle of Man Steam Navigation Company, Limited, and the *Cabo Penas* and *Cabo Quejo* for the Spanish firm of Messrs. Yburro & Co. Messrs. Jos. L. Thompson & Sons have, during the past year, acquired a large forge at Pallion, for the manufacture of their heavy forgings. They have also introduced into their yard additional machinery of an improved type, although, as is well known, in this respect they have for years compared more than favourably with their competitors. The most recent addition is a new machine for cutting angle bars obliquely. Considering the enterprising character of this firm, and the great attention that they pay to the question of building steamers that will be specially commercially successful, it is not surprising to learn that they have now their order books so full that a large increase of work for the year 1888 is ensured.

Mr. James Laing, of the Deptford Shipbuilding Yards, has launched eight steam vessels of 17,809 tons, and this also shows an important increase as compared with 1886, when only five vessels of 9,684 tons were launched. With the solitary exception of a small screw steamer of 100 tons, all the vessels built at the Deptford yards were of steel.

Messrs. Wm. Doxford & Sons, Pallion, have not had their establishment so fully employed, but despite this drawback, they have succeeded in launching about four times the tonnage launched in 1886, viz., six steam vessels of 13,163 tons. One of the vessels is a torpedo boat built on speculation, in which the boiler is fired with liquid fuel. There have been several preliminary trials with this vessel of a satisfactory character, and no difficulty has been experienced in using the "liquid fuel." More especially for torpedo boats and similar light craft, where the question of the maximum speed with the minimum weight of fuel is all important, there would appear to be a future for liquid fuel even in the United Kingdom, provided the "roar" consequent on the combustion of the mingled oil and steam could be obviated, a task, we should think, not impossible of being achieved. It is also a matter of hope on the Wearside that this torpedo boat may be only the forerunner of several flotillas of such craft to be built in the local shipbuilding yards. The largest vessel launched on the Wear was the *Trans-Pacific*, from the yard of Messrs. Wm. Doxford & Son, but although it was launched in February, it has not yet found a purchaser.

Messrs. Short Bros., Pallion, stand next on the list, and from their yard there has also been an increased output in 1887 as compared with 1886. In the last-mentioned year the amount of tonnage launched was 7,508 tons, while in 1887 there were six vessels of 10,160 tons launched, an increase in tonnage of 2,652 tons. Four of the vessels were steel steamers of above the average tonnage, and the remaining two were of iron, and each 527 tons gross register. As is now tolerably widely known, this firm is well employed, and has also a good number of orders in hand, and recently re-arranged the berths in their shipbuilding yard so as to accommodate a larger class of vessel.

The Sunderland Shipbuilding Company, Limited, South Docks, also are to be congratulated upon an increased output, not only

as compared with 1886, but also with 1884 and 1885. In 1884 the tonnage launched was 3,242 tons, in 1885 it fell to 1,867 tons, in 1886 a slight improvement occurred, and 2,413 tons were launched, and now in 1887, seven vessels, of 5,245 tons, were sent into their native element. One of these vessels was a small steel sailing vessel, and the remainder were iron screw steamers. This company has been recently fortunate in securing orders, among the number being a large steel steamer, with triple-expansion engines, for Messrs. F. Gordon & Co., of Sunderland and London.

The defunct firm of Messrs. Boolds, Sharer & Co., of Pallion, launched during the year the large steel steamer, *Pio IX.*, built to the order of a Spanish firm, but up to the present moment there are no signs of their yard or of that of the North of England Shipbuilding Company, Limited, being re-occupied.

Messrs. Bartram, Haswell & Co., South Docks, have also only launched one steamer this year, but as the tonnage is 2,774 gross register, their return compares favourably with the year 1886, when 2,515 tons were launched, and also with the years 1884 and 1885, in the last-mentioned year there being no launch. This firm has also carried out large repairs upon one steamer amounting in reality to its re-construction.

Messrs. John Blumer & Co., North Docks, have launched three steamers during 1887, one of which, the River Wear Commissioners' large twin screw barge, *Concrete*, has no tonnage assigned, but their total output may be assumed at 3,300 tons, greater than in any year since 1883. In 1886 there was no launch from this firm's yard. One of the vessels launched by Messrs. J. Blumer and Co. in 1887 was a steel steamer.

Messrs. Wm. Pickersgill & Sons have launched two iron sailing ships during 1887, of 2,735 tons combined tonnage, as compared with *nil* in 1886, and a tonnage of 2,261 tons in 1885. This firm recently received an order for a duplicate steamer to that building by the Sunderland Shipbuilding Company, Limited, for the same owners, Messrs. F. Gordon & Co.

The Strand Slipway Company, Sunderland, have only launched one iron steamer in 1887, and are sailing her on their own account. In this instance the tonnage result, 1,830, shows a slight diminution as compared with 1886—in 1885 they had no vessel launched.

Messrs. S. P. Austin & Son, Wear Dockyard, launched two craft in 1887, one being an iron screw steamer and the other a steel pontoon, and here we have another instance of slightly decreased output. As, however, this firm has carried out considerable re-constructions and large repairs, including the rebuilding and *classing* of the *Pakshan*, late the *Delphus*—the first historical instance of a constructively lost steel steamer—the actual statistics are somewhat delusive.

Messrs. Osbourne, Graham & Co., North Hylton, is another firm which launched no vessels in 1886, but in 1887 they have succeeded in finding a purchaser for the iron screw steamer so long on the stocks, henceforth to be known as the *Giralda*, of 1,150 tons, and accordingly they are to be included amongst the "fortunate" ones. Steady progress is being made with the steel steamer on the stocks, and we have no doubt that in the year 1888 there will be a degree of briskness in their establishment unfortunately not known of late.

There are, besides one shipbuilding company already mentioned, two firms who have been practically at a standstill during the greater portion of 1887, viz., Messrs. J. Priestman & Co. and Messrs. R. Thompson & Sons, Southwick. The latter firm, although they have not launched any vessel, have, however, had a large amount of repairing and overhauling work, and may, we anticipate, be in a position to have a decent show on the records for 1888.

Messrs. Knox & Co., who figured in 1886 statistics, as having turned out 700 tons, is now defunct.

West Hartlepool. This port, we believe, will be found to have had a far greater proportionate increase in the tonnage of vessels launched in 1887 than any other port in the United Kingdom. In 1885 the output of tonnage was 33,030 tons, in 1886 there was a heavy falling off, only 15,293 tons being launched, but in 1887 these figures have been more than trebled, 22 screw steamers of 53,632 tons having been launched. Messrs. William Gray & Co. contributed the largest number of vessels' tonnage to this total, having launched 12 screw steamers of 30,243 tons during the year, all constructed of Siemens-Martin steel. The smallest tonnage of these vessels was 2,223 tons gross register, and the largest registered 2,901 tons gross, the average tonnage of Messrs. Gray and Co.'s vessels being 2,520 tons gross register. Similarly, the N.H.P. varied from 200 to 280. We call attention to these figures as they show that the ordinary deadweight carriers, many of them well-deckers, built during the past year, have been vessels carrying about 3,000 tons deadweight and upwards.

Messrs. Edward Withy & Co., of West Hartlepool, have also had a large number of launches during, let us hope, the last year of the "bad times." Besides having had a large amount of repairing and alteration work this well-known firm have launched nine screw steamers of 19,889 aggregate tonnage, and 1,715 combined N.H.P. That this result will be eclipsed in 1888 is extremely probable, as work at the establishment of Messrs. Edward Withy & Co. is at present unusually active. The gross register tonnage of the vessels built by this firm during 1887 varied from 1,803 to 2,371 gross register tons, affording another example of one of the leading signs of the times. Another feature, now becoming extremely common, is that in every instance the vessels built by Messrs. Edward Withy & Co. were fitted with engines of the latest type—triple-expansion. Only one, and that the smallest vessel that this firm launched during the past year, was constructed of iron, the remainder being built of Siemens-Martin steel. Not only in these respects, but also in the care exercised in giving to the shipowners of vessels all necessary information relating to the loading qualities of their vessels, and full and complete particulars of their stability, &c., is the firm of Messrs. Edward Withy & Co. fully abreast of the times. Messrs. R. Irvine & Co., of West Hartlepool, also contributed a quota to the vessels launched during 1887, having built one steel screw steamer of 3,500 tons gross register.

The Tees. There has also been a decided improvement in shipbuilding on the Tees during the past year, and the prospects for the year 1888 are encouraging. In 1885, 57 vessels of 34,338 tons were launched, in 1886 there was a marked decrease to 11 vessels of 20,476 tons, and now for the year 1887 we have to chronicle a result better than in either of the two previous years, as 35 vessels of 35,346 tons were launched. As usual, Messrs. Raylton, Dixon & Co., Cleveland Dockyard, Middlesborough, head the list, having built 11 vessels of 15,068 tons. Seven of the number were steel screw steamers varying from 551 to 2,924 gross register tons. One of these vessels, the *Garigliano*, was built to the order of the Italian Government, and in other two instances the vessels were for foreign customers. The four remaining vessels were large iron barges for Middlesbro'. During the first half of the year Messrs. Raylton, Dixon & Co. were fairly busy, but in the latter half their establishment was not so fully employed with new work, although they executed considerable repairing, re-fitting, and alteration contracts. They have now four steamers on the stocks, and are hopeful of having fairly brisk times in 1888.

Messrs. M. Pearse & Co., of Stockton, stand next in order, taking the output of tonnage as our guide, and in this instance there has been an increased output as compared with the previous year. During 1887, they had launched three steel steamers each of large tonnage, aggregating 8,851 gross register tons having 945 combined N.H.P. In 1886, the output of Messrs. M. Pearse & Co.'s establishment was only 6,553 gross register tons, so that this last year has witnessed an increase of 2,298 tons. The average tonnage of the steam vessels built by the last-mentioned firm in 1887 was 2,950 tons.

Messrs. Richardson, Duck & Co., of South Stockton, have launched the greatest number of vessels on the Tees during the last year, viz, 17 of a combined gross register tonnage amounting to 6,920 tons. Fourteen of these vessels were small barges and the remainder screw steamers varying in tonnage from 1,913 to 2,210 tons gross register. One of the three screw steamers was built of iron, as also the barges, but the remainder were of Siemens-Martin steel, one of the steel steamers being for foreign owners. Altogether the work executed last year by Messrs. Richardson, Duck and Co. slightly exceeds that of the previous year.

Messrs. Craig, Taylor & Co., Stockton-on-Tees, who have only been a few years in business, have, under the circumstances, a very creditable result to show for their year's working. In 1886 they only launched one steamer, but in the year just closed they have sent afloat four steam vessels of an aggregate tonnage amounting to 4,507 tons gross register, and having a combined N.H.P. of 420. The vessels vary in tonnage from 248 to 1,458 tons, the average tonnage of the vessels launched being 1,126 gross register tons. Only in the case of the smallest vessel was the ordinary quality of shipbuilding iron used, the three large steamers being constructed of Siemens-Martin steel, one of them being built for a foreign customer. Having secured a number of orders, there is every prospect that Messrs. Craig, Taylor & Co. will have a still greater output from their establishment in the year just opening.

Messrs. W. Harkiss & Son, East Slipway, Middlesbro' have been actively employed with repairing work, but have not launched any vessels during the last year. A similar remark

holds true of Messrs. R. Craggs & Sons, of the Cleveland Slipway, Middlesbro', who have, however, constructed a steel screw steamer of 2,400 tons, which will be soon ready for launching.

Whitby is another port from which an increased output for the year 1887, as compared with the previous one, is reported. Three vessels have been built during the past year of 4,878 aggregate gross register tonnage, while in 1886, three vessels of 2,021 tons were launched. Messrs. Turnbull & Son contributed the bulk of the tonnage, viz., 4,784 tons, having built two screw steamers, one being constructed of iron and the other of steel—the former for London, and the latter for Whitby owners. The Whitby and Robin Hood's Bay Shipbuilding and Graving Dock Company, Limited, built the remaining craft, a wooden fishing smack.

The Humber. In this instance the result of the last year's working unfortunately shows a decrease in the work executed in the local shipbuilding yards, as compared with the previous year; although the output is in excess of that of 1885. In the last-mentioned year 12 vessels of 6,191 tons were launched, in 1886 a considerable increase occurred, 27 vessels of 11,750 tons being put off the stocks, while in 1887 there were only nine vessels of 9,763 tons launched.

As usual, almost the entire shipbuilding of the Humber has been carried on by Earle's Shipbuilding and Engineering Company, Limited, who have sent off the stocks seven steam-vessels of the aggregate tonnage of 9,578 gross register tons, and 1,275 combined N.H.P. By far the larger proportion of tonnage was built of steel, viz., 7,680 tons—the remainder 1,898 tons being of iron. We regret to learn that the immediate prospects of this company are not promising, but possibly before this appears in print they may become brighter.

Mr. W. Caisley, of Howden, is the only remaining shipbuilder on the Humber, according to the returns at present to hand, who has built any vessels during the past year, viz., two wooden sailing vessels of 185 aggregate gross register tons.

From this brief review of the shipbuilding of the North-East Coast during the past year, it will be seen that on the whole there has apparently been an increase of work executed in 1887. Although figures and facts are stubborn things, yet it must not be overlooked that in not a few instances the vessels launched during the past year have been constructed and ready for launching, in some instances, even two and three years, but making all allowances, it is evident that some improvement has been experienced in shipbuilding in 1887. What is even more satisfactory is that the prospects for the New Year are generally favourable, and whatever other years to come have in store, that of 1888 will witness a welcome briskness in many of our shipbuilding yards.

An order has been received at the dockyards from the Admiralty directing for the future in steam trials of commissioned ships the engines must not be driven to develop more than the power realised by the contractors with open stokeholds. It has been found that by propelling ships on these trials at unnecessary and wholly exceptional rates of speed the hull and machinery are greatly strained.

Fast Ocean Steaming.—The Peninsular and Oriental Steam Navigation Company's steamer *Britannia* arrived at King George's Sound, Western Australia, the afternoon of December 8th, eight days early, having made an unusually quick run from London. This passage gives a transit from Brindisi to Australia, including detention in Egypt waiting for the mails, the detour to Ceylon and detention there for nearly 36 hours, of 23 days 10 hours, and a continuous speed at sea for a distance of 8,000 miles of, within a fraction, 16 knots.

Hoar and Brown's Teak Market Report.—The recent extraordinary excitement that has existed in other markets, resulting in almost unprecedented advances in prices, has, somewhat tardily, we confess, at last affected this branch of trade. Very large orders for ships have lately been given out, which will keep our shipyards well employed for many months to come. Shipbuilders are beginning to awaken to the fact that markets generally are improving, and recent sales of teak certainly show a decided improvement both for cargoes afloat and for stocks here. We cannot, therefore, too ardently urge intending purchasers to fill up their requirements as quickly as possible, for where in recent circulars we only hinted at a probable rise, we can now confidently record this as an accomplished fact. We do not say this from any idle wish to influence buyers; the above facts can be proved by a simple comparison of present prices with those quoted only a month ago, and by recent deliveries of teak from the docks.—December, 1887.

LAUNCH AND TRIAL TRIP OF STERN WHEEL STEAMER AT BANGKOK, SIAM.

On October 17th there was launched from the building yard of the Bangkok Dock Co. the first steamer of the newly formed Meinam Flotilla Company, for whom the Borneo Company are the managing agents. The company has been formed to build a number of steamers and barges to open up trade in the interior of Siam. They intend working in a similar manner to the Irrawaddy Flotilla Company in Burmah. This vessel is of the flat bottomed stern-wheel type, to suit the shallow parts of the river. She was designed and built by Messrs. D. J. Dunlop & Co., Port Glasgow, shipped out in pieces, and rebuilt by the Bangkok Dock Company. Length, 103 ft.; beam, 24 ft. 6 in.; depth, 4 ft. Her plates are $\frac{3}{16}$ galvanized Siemens-Martin steel. Her decks, cabins, &c., are all of teak, and were made and fitted by the Bangkok Dock Co. The engines are compound; diameter of cylinders, 17 in. and 32 in., with a stroke of 3 ft. They are placed as usual right aft, while the locomotive boiler is forward. The wheel is composed of steel, and is 11 ft. 6 in. diameter. A trial trip was made on the 4th November, when nearly one hundred guests were present, on the invitation of Mr. Leckie, manager of the Borneo Company. Amongst those present were H.R.H. Prince Dewan, Foreign Minister; Mr. Gould, British Consul; Count Kerderoo, French Consul; Colonel Child, American Consul; Captain Hicks, surveyor to Lloyd's agents (who superintended the erection of the vessel on behalf of the Meinam Company). The vessel was under command of Captain Main, and the builders were represented by Mr. M'Ouat, of Messrs. Dunlop & Co.'s, and Mr. Mackay, superintendent engineer of Bangkok Dock Company. A very successful run was made up river, when the average speed was ascertained to be about 10 knots, the engines working very smoothly, 40 revolutions with and 35 against the tide. Her steering capabilities were also tested, and gave great satisfaction. During the run tiffin was served in excellent style by the Oriental Hotel Company. On her return she was stopped opposite the palace, and boarded by H.R.H. the Crown Prince, who kindly officiated at the christening ceremony, naming the vessel *Chow Phya*. As a memento of the occasion he was presented with a massive silver box by Mr. Leckie. On the day following his Majesty the King paid a visit to the vessel privately, and expressed great interest in her as the first stern wheeler on the Meinam, and wished the company every success. The *Chow Phya* commenced running on November 8th, taking about 12 tons of salt as cargo, and 12,000 pieces of firewood as fuel on a draft of 20 inches. She had in tow 50 cargo boats, taking them up country to load paddy. The company have commenced building steel barges, and it is expected another steamer will soon be under way.

The undermentioned have been awarded medals for long service and good conduct:—Thomas Needham and G. H. Jackson, engine-room artificers, of the *Pembroke*; S. Dawson, chief engine-room artificer, and C. H. Allison, engine-room artificer, of the *Asia*; W. W. Short, leading stoker, of the *Indus*; W. Kimber, leading stoker, of the *Dreadnought*.

Liverpool Exhibition of 1887.—A Loss of Fifty Thousand Pounds.—The guarantors of the Liverpool Exhibition of 1886, who extended their guarantee to the Exhibition of the present year, which closed a few weeks ago, have just received a circular from the executive council informing them that the results, on an approximate estimate, of the receipts and expenditure of 1887 is to leave a balance of £50,897 18s. 11d. to be provided for, and that the building and other assets cannot be estimated to realise more than £15,000. The whole of the guarantee fund of £34,289 12s. (after deducting the amount paid on account of the Exhibition of 1886) will therefore be required, and the council call for an early payment, adding that interest at the rate of 5 per cent. per annum will be charged on all amounts remaining unpaid after the 14th inst. Although it was generally expected that the working of the present year's Exhibition would result in a considerable loss, the actual amount of the deficit has occasioned some surprise, and a large number of the guarantors are not disposed to pay anything until the council place before them some more detailed statement of receipts and expenditure. At present all the information they have received is the estimate of the deficit, no other particulars being given. When the whole amount of the guarantee is paid up there will still be a loss, and this, it is stated, will have to be made up by the members of the executive council personally.

LIST OF VESSELS LAUNCHED IN 1887.

ENGLISH.

By Finch & Co., Limited, Chepstow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
• The Earl	Iron	Steam	British	101	70
• Mourne	,,	,,	,,	77	35
• Victoria	Steel	,,	Foreign	82	40
• Alice..	,,	,,	,,	12	10

By Craig, Taylor & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Benholm	Steel	Steam	British	1,457	120
† Bengar	,,	,,	,,	1,457	120
• Oakwell	Iron	,,	,,	248	50
† Torre-del-Oro ..	Steel	,,	Foreign	1,343	130

By Earle's Shipbuilding and Engineering Co., Limited, Hull.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
• Auckland	Steel	Steam	British	210	65
† Colorado	,,	,,	,,	4,220	450
† Emden	Iron	,,	,,	786	150
† Apollo	Steel	,,	,,	3,260	300
† Scorpio	Iron	,,	,,	145	45
† Sagittarius.. ..	,,	,,	,,	145	45
• Peterboro'	,,	,,	,,	822	220

By the Tyne Iron Shipbuilding Co., Limited, Willington Quay.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Linda	Steel	Steam	British	2,424	300
† Karnak	,,	,,	Foreign	2,520	300

By Boolds, Sharer & Co., Pallion, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Pio IX.	Steel	Steam	Foreign	4,030	450

By S. P. Austin & Son, Wear Dockyard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† John and Albert ..	Iron	Steam	Foreign	1,663	130
Pontoon	Steel	—	British	—	—

By W. Pickersgill & Sons, Southwick, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Arute	Iron	Sail	British	1,335	—
Mary Roberts ..	,,	,,	,,	1,398	—

By the Blyth Shipbuilding Co., Limited, Blyth.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† [illegible] City ..	Steel	Steam	British	2,160	220

[illegible]ound. † Triple.

By Edward Withy & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Vulcan	Steel	Steam	British	2,205	190
† Manitoba	,,	,,	,,	2,127	200
† Rockcliff	,,	,,	,,	2,288	180
† Lydie	Iron	,,	,,	1,803	155
† Picton	Steel	,,	,,	2,371	200
† Roddam	,,	,,	,,	2,365	200
† Heathfield	,,	,,	,,	2,140	190
† Amphitrite	,,	,,	,,	2,295	200
† Melbourne	,,	,,	,,	2,295	200

By M. Pearse & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Fastnet	Steel	Steam	British	2,296	200
† Cordoba	,,	,,	Foreign	2,847	250
† Asama	,,	,,	British	3,708	495

By Laird Bros., Birkenhead.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
• Shipped in pieces ..	Steel	Steam	Foreign	110	50
• ,, ,, ..	,,	,,	,,	140	60
• ,, ,, ..	,,	,,	,,	140	60
• ,, ,, ..	,,	,,	,,	140	60
• ,, ,, ..	,,	,,	,,	140	60
† Olga..	,,	Screw	British	902	350
† Esperanca	,,	,,	Foreign	500	150
† Perseverance ..	,,	,,	,,	500	150
• Shipped in pieces ..	,,	Paddle	,,	90	30

By W. H. Potter & Sons, Queen's Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
• Rescue	Iron	Steam	British	563	200
† Auta	Steel	,,	Foreign	44	35
† Taal	,,	,,	,,	253	71
† Prospero	,,	,,	British	499	71

By Wm. Gray & Co., West Hartlepool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Worcester	Steel	Steam	British	2,898	260
† Oxford	,,	,,	,,	2,901	260
† Wave	,,	,,	,,	2,370	200
† Goldsbro'	,,	,,	,,	2,247	200
† Swansea	,,	,,	,,	2,809	280
† Hampstead.. ..	,,	,,	,,	2,244	225
† Springfield	,,	,,	,,	2,242	220
† Henley	,,	,,	,,	2,243	225
† Flambro'	,,	,,	,,	2,223	200
† Elton	,,	,,	,,	2,500	250
† Twickenham ..	,,	,,	,,	2,510	250
† Montana	,,	,,	,,	2,875	280

By Short Bros., Pallion, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† J. T. Short.. ..	Steel	Steam	British	2,218	200
† Belle of Dunkerque	Iron	,,	,,	527	60
† Herongate	,,	,,	,,	526	60
† Roman Prince ..	Steel	,,	,,	1,934	180
† Eastern Prince ..	,,	,,	,,	2,147	200
† J. W. Taylor ..	,,	,,	,,	2,808	220

• Compound. † Triple.

By Elliott & Jeffrey, West Bute Dock, Cardiff.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Sir W. T. Lewis ..	Iron	Steam	British	145	80

By John Readhead & Co., West Docks, South Shields.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Tockwith	Steel	Screw	British	2,214	1,143
† Brampton	,,	,,	,,	2,105	1,186
† Fanfulla	,,	,,	Foreign	2,743	1,212
† Ethelburga.. ..	,,	,,	British	2,223	1,347
† Gem	,,	,,	,,	2,098	1,170
† Tafna	,,	,,	,,	2,231	1,036

By Cook, Welton & Gemmell, South Bridge, Hull.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Industria	Iron	Steam	British	133	35
* Bournemouth ..	,,	,,	,,	136	40
* Francis	Steel	,,	,,	25	10
* Chindwin	Iron	,,	,,	128	45

By Samuda Bros., Poplar.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Achille Adam. ..	Steel	Steam	British	434·31	100
Gibraltar Craft ..	,,	—	,,	30	—
* Jubilee (Life) No. 1	,,	Steam	,,	134	70
Dredger	,,	—	Foreign	162	—
Pontoon	,,	—	,,	21	—

By Cochran & Co., Birkenhead.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Anna	Steel	Screw	Foreign	100	165
Beschorner	Iron	Sail	,,	15	—
Hutton	Wood	,,	,,	10	—
Fuddooanee	Steel	Screw	—	20	60
† Pedro de Castille ..	,,	,,	—	80	100
Conway R. Dobbs ..	,,	,,	British	15	40
Walkden	Wood	,,	Foreign	8	30
Walkden, No. 2 ..	Iron	Tow.	,,	20	—
Leonora	Steel	Screw	British	36	100
Jubilee	Wood	,,	,,	10	30
Walford	,,	,,	Foreign	6	20
No. 79.. ..	Composite	—	,,	7	—
Vlanderen	Wood	Screw	,,	6	20
Lily	Steel	,,	British	15	60
Pirate	Iron	Tow.	,,	60	—
Editha	Wood	Screw	,,	8	15
Torpedo	,,	,,	,,	6	20
Don Pedro	Iron	Tow.	Foreign	10	—
Clara	Wood	Screw	,,	6	20
Emelihi	,,	,,	,,	7	20

By the Sunderland Shipbuilding Co., Limited, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Ardbeg	Iron	Steam	British	2,255	180
† Japigia	,,	,,	Foreign	1,196	140
* Kinyo Maru ..	,,	,,	,,	515	80
* Plymouth	,,	,,	British	252	80
Bradley	Steel	Sail	,,	54	—
† Kydouiai	Iron	Steam	Foreign	414	90
† Galatea	,,	,,	British	559	95

* Compound. † Triple.

By Edwards & Symes, Cubitt Town, E.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
‡ Cuckoo	Steel	Steam	British	—	6
* Tugboat	,,	,,	,,	30	40
* Mexico	,,	,,	Foreign	80	25
Barge	,,	—	,,	60	—
Barge	Composite	—	,,	60	—
Barge	Steel	—	,,	25	—
Barge	,,	—	,,	25	—
Barge	,,	—	,,	25	—
Lifeboat	Wood	—	British	—	—
Lifeboat	,,	—	,,	—	—
‡ Launch	Steel	Steam	,,	5	4

By Joseph T. Eltringham, South Shields.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Protector	Iron	Steam	British	140	80
Flying Swallow ..	,,	,,	,,	131	80
William Gray ..	Steel	,,	,,	118	75
* Dolphin	Iron	,,	,,	110	40

By Head & Barnard, Hull.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
* Her Majesty ..	Iron	Steam	British	138	45
* Python	,,	,,	,,	—	20
Barge	—	—	,,	90	—

By Philip & Son, Dartmouth.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Thalatta	Wood	Steam	British	82·46	35

By W. White & Sons, "Vectis Works," West Cowes, Isle of Wight.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Bulldog	Wood	Steam	British	23·32	12
* Queen Marfisa ..	Steel	,,	,,	127·31	42
* Luna	,,	,,	,,	78·93	25

By J. F. Waddington & Co., Seacombe, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
‡ Gloria	Steel	Steam	Foreign	18	8
* Furao	,,	,,	,,	60	25
‡ Stuart	,,	,,	British	25	16
‡ Launch, No. 7 ..	,,	,,	,,	25	16
Barge, No. 8	,,	Tow.	,,	35	—
Barge, No. 9	,,	,,	,,	35	—
‡ England's Queen ..	,,	Steam	,,	25	16
‡ Dayspring	,,	,,	,,	25	16
C. J., No. 1	,,	Tow.	,,	35	—
Walter	,,	,,	,,	35	—
* Firefly	Iron	Steam	,,	170	52
‡ Ariel	Steel	,,	,,	25	16
* Olinda	,,	,,	Foreign	20	8
Lifeboat	Wood	Sail	British	—	—

By Brundrit & Co., Runcorn.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
Percy	Wood	Sail	British	81	—

* Compound. † Triple. ‡ High Pressure.

By Yarrow & Co., Poplar.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
[illegible] Torpedo Boats ..	Steel	Steam	British	—	—
[illegible] Torpedo Boat ..	,,	,,	,,	—	—
[illegible] Stern Wheel Steamr.	,,	,,	Foreign	—	—
1 Torpedo Boat ..	,,	,,	,,	—	—
[illegible] Steam Launch ..	,,	,,	,,	—	—
[illegible] Stern Wheel Steamr.	,,	,,	,,	—	—
1 .. .. ,,	,,	,,	,,	—	—
[illegible] Torpedo Boats ..	,,	,,	,,	—	—
1 Stern Wheel Steamr.	,,	,,	,,	—	—
[illegible] Barge	,,	—	,,	—	—
[illegible] Stern Wheel Steamr.	,,	Steam	,,	—	—
[illegible] Gunboat	,,	,,	,,	—	—
[illegible] Torpedo Boats ..	,,	,,	British	—	—
1 Steam Launch ..	,,	,,	Foreign	—	—

By Oswald Mordaunt & Co., Southampton.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
[illegible]	Iron	Sail	British	2,526	—
* [illegible]	Steel	Screw	Foreign	1,609	150
[illegible]	Iron	Sail	British	2,293	—
* [illegible] Yacht ..	,,	Screw	,,	194	56
* [illegible]	,,	,,	,,	3,232	340
* [illegible]	,,	,,	,,	469	75

By [illegible] & Co., St. Phillips, Bristol.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* [illegible] ..	Steel	Steam	Foreign	40	30

By [illegible] & Son, Whitehall, Whitby.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
[illegible]	Iron	Steam	British	2,408	175
[illegible] ..	Steel	,,	,,	2,376	180

By [illegible], Great Grimsby.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
[illegible]	Wood	Sail	British	34	—

By the [illegible] Shipbuilding Co., Penarth.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* [illegible]	Iron	Steam	British	341·36	65
[illegible] ..	Steel	,,	,,	31·20	—

By [illegible], Brunswick Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Metropolis ..	Iron	Sail	British	1,810	—

By [illegible] & Sons, Kingsbridge.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
[illegible] ..	Wood	Sail	British	114	—

* Compound. † [illegible]

By Smith & Stevenson, Perseverance Works, Great Grimsby.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Queen's Jubilee ..	Wood	Sail	British	81	—
Coriolanus	,,	,,	,,	50	—
Volunteer	,,	,,	,,	81	—
Thistle	,,	,,	,,	—	—

By Cox & Co., Falmouth.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
* Sir John Jones ..	Steel	Screw	British	60·5	30
* Sir Richard Fletcher	,,	,,	,,	60·5	30
* Maria Gertrudis ..	,,	,,	Foreign	101·34	25

By the Barrow Shipbuilding Co., Barrow-in-Furness.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P.
Nordenfeldt (sub. bt.)	Steel	Steam	British	68	1,000
Bazalgette	,,	,,	,,	673	800
Grangeuse	,,	,,	,,	419	550
Hainaut	,,	Sail	Foreign	1,760	—
H.M.S. Buzzard ..	—	—	—	—	2,000

By Thomas Campbell, Fish Dock, Great Grimsby.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H P. N.
Lizzie Carter ..	Wood	Sail	British	40	—
Florence Heneage ..	,,	,,	,,	72	—
George Heneage ..	,,	,,	,,	77	—

By Williamson & Son, Workington.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Silverdale	Iron	Sail	British	1,920	—
† Holme Force ..	Steel	Steam	,,	266	55
Boadicea	,,	Sail	,,	1,938	—

By Clark & Co., Brimscombe, near Stroud, Gloucester.

Name of Vessel.	Built of	Class.	Owners.	Length Beam.	H.P. N.
‡ Doris	Steel	Steam	Foreign	35× 6	4
‡ Thetis	,,	,,	British	47×7-6	8
‡ Darling	,,	,,	Foreign	35× 6	4
‡ Laputa	,,	,,	British	35× 6	4
‡ Celuta	,,	,,	,,	28× 5	2

By Sir W. G. Armstrong, Mitchell & Co., Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
H.M.S. Victoria ..	Steel	Steam	British	6,000	12,000
Minister Mayback ..	,,	,,	Foreign	2,486	1,100
Willkommen	,,	,,	,,	2,896	1,200
Energie	,,	,,	,,	640	450
Drudge	Iron	,,	British	438	300
Olinda..	Steel	,,	Foreign	2,428	1,400
Ville de Calais ..	,,	,,	,,	1,837	800
Hans & Kurl.. ..	,,	,,	,,	2,158	850
Ascania	,,	,,	,,	2,056	1,000
Colonia	,,	,,	,,	2,052	1,000
No. 514, Ship ..	,,	,,	,,	360	750
No. 515 ,, ...	,,	,,	,,	265	650
No. 516 ,, ...	,,	,,	,,	265	6[illegible]
Otelo	,,	,,	,,	1,099	7[illegible]

* Compound. † Triple. ‡ High Pressure.

By Wigham, Richardson & Co., Neptune Works, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Riverina	Steel	Steam	British	2,883	1,700
Rosario	Iron	,,	Foreign	1,790	2,560
Port Fairy	Steel	,,	British	2,539	2,100
Hindoo	,,	,,	Foreign	420	1,900

By Raylton, Dixon & Co., Cleveland Dockyard, Middlesborough.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Haitan	Steel	Steam	Foreign	1,856	350
Electrician	,,	,,	British	2,924	375
Garigliano	,,	,,	Foreign	648	120
Gulf of Aden	,,	,,	British	2,470	450
Gulf of Trinidad	,,	,,	,,	2,469	450
Newport, No. 1	Iron	Barge	,,	427	—
,, No. 2	,,	,,	,,	427	—
,, No. 3	,,	,,	,,	427	—
,, No. 4	,,	,,	,,	427	—
Tartar	Steel	Steam	,,	2,442	400
Eugalia	,,	,,	Foreign	551	80

By Thos. Royden & Sons, Queen's Pier Head, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Maxwell	Iron	—	British	1,856	—
Balmoral	,,	—	,,	2,092	—
* Barges	Steel	—	,,	55	—

By Schlesinger, Davis & Co., Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Puffin	Composite	Sail	British	180	—
* Kate B. Jones	Steel	Steam	,,	1,983	180

By Palmer's Shipbuilding & Iron Co., Limited, Jarrow-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Earnmoor	Steel	Steam	British	2,009	1,250
Era	,,	,,	,,	1,850	1,150
Hopetown	,,	,,	,,	2,115	1,120
Clapet XI.	Iron	,,	Foreign	299	300
Clapet XII.	,,	,,	,,	301	300
Clapet XIII.	,,	,,	,,	301	300
Clapet XIV.	,,	,,	,,	301	300
Acme	Steel	,,	British	2,145	1,180
Starling	,,	,,	,,	790	750
Bateaux Citerne, No. 1	Iron	,,	Foreign	85	160
,, ,, No. 2	,,	,,	,,	85	160
Locksley Hall	Steel	,,	British	4,016	2,500
Branksome Hall	,,	,,	,,	4,016	2,500
Alice Depeaux	,,	,,	Foreign	1,005	950

By W. Doxford & Sons, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Transpacific	Steel	Steam	—	5,570	800
No. 169 (Torpedo Bt.)	,,	,,	—	85	300
Haverstoe	,,	,,	—	2,105	181
Fee Cheu	,,	,,	—	1,034	180
Viceroy	,,	,,	—	2,197	181
Junio	,,	,,	—	2,172	181

* Triple.

By Camper & Benjamin Nicholson, Gosport.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Amphitrite	Wood	Sail	British	160	—
† Albion	,,	Steam	,,	176	45

By Thos. & Wm. Smith, North Shields.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Corriere-di-Livorno	Iron	Steam	Foreign	226	50

By Wood, Skinner & Co., Bill Quay, Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Sodium	Steel	Steam	British	141	45
* Cragside	Iron	,,	,,	129	30
† Platon	Steel	,,	Foreign	1,034	120
† Nicolai	,,	,,	,,	1,034	120

By Swan & Hunter, Wallsend-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P.
† Carmarthenshire	Steel	Steam	British	2,726	2,500
† Paris	,,	,,	,,	380	350
† New Amsterdam	,,	,,	,,	103	200
† Elingamite	,,	,,	,,	2,585	2,000
† Fifeshire	,,	,,	,,	3,718	2,450
† Antwerpen	,,	,,	Foreign	1,726	1,100
† Bellina	,,	,,	,,	2,648	1,500
† Courier	,,	,,	British	728	3,000

By Forrestt & Son, Norway Yard, Limehouse.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
‡ Midge	Wood	Steam	—	12	14
‡ Dart	Steel	,,	British	5	5
Cutter	Wood	Sail	Foreign	—	—
Pilotos	Iron	,,	,,	—	—
Whale Boat	Steel	,,	British	—	—
§ Dungarvan	Wood	,,	,,	—	—
§ Scarborough	,,	,,	,,	—	—
§ Pembry	,,	,,	,,	—	—
§ Ramsgate	,,	,,	,,	—	—
§ Whitby	,,	,,	,,	—	—

Twenty-one Lifeboats for various stations. The Jubilee National Lifeboat, "Queen Victoria," built for Bembridge, and christened by the Duchess of Edinburgh.

By Miller, Tupp & Rouse, Hammersmith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
‡ Robin	Wood	Steam	British	2	2
‡ Skylark	,,	,,	,,	2	1
‡ Cockroach	,,	,,	Foreign	2	2
* Nama	Composite	,,	,,	30	20
Pioneer	Wood	Sail	British	1	—

By the Strand Slipway Co., Monkwearmouth, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Industry	Iron	Steam	British	1,830	150

* Compound. † Triple. ‡ High Pressure.

§ Royal National Lifeboats.

By Mr. Laing, Shipbuilding Yard, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Montauk	Steel	Screw	British	2,404	1,350
Lake Ontario	,,	,,	,,	4,502	3,000
Mineola	,,	,,	,,	2,404	1,350
Ooryia	,,	,,	,,	1,050	1,000
Ville de Metz	,,	,,	Foreign	3,386	2,200
Cheniston	,,	,,	British	1,987	1,350
Elvaston	,,	,,	,,	1,976	1,350
Les Bormettes	Iron	,,	Foreign	100	60

By Steward & Latham, Britannia Yard, Millwall.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Jubilee	Steel	Steam	British	47·40	33
* Witch	Iron	,,	,,	85	22
* Puerto Santa Maria	Steel	,,	Foreign	35	20
Regina	Iron	Barge	British	110	—

By Richardson, Duck & Co., Stockton-on-Tees.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Matleporits	Steel	Steam	Foreign	1,913	160
† Glenfield	Iron	,,	British	2,127	170
14 Barges	,,	—	,,	670	—
† Somerhill	Steel	Steam	,,	2,210	170

By Bartram, Haswell & Co., South Docks, Bishopwearmouth, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Olive Branch	Steel	Steam	British	2,745	300

By John Jones & Sons, Brunswick Dock, Liverpool.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Bencroy	Steel	Screw	British	2,516	150
* Gwynfaen	Iron	,,	,,	255	54
2 Barges	Steel	—	Foreign	—	—

By Wm. Dobson & Co., Newcastle-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Calder	Steel	Steam	British	661	980
† Peter	,,	,,	Foreign	999	686
† Dimitri	,,	,,	,,	1,000	686

By Joseph L. Thompson & Sons, North Sands, Sunderland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
† Robt. Harrowing	Steel	Steam	British	2,155	240
† Foyle	,,	,,	,,	2,454	300
† Lancashire Witch	,,	,,	,,	762	250
† Cabo Penas	,,	,,	Foreign	1,743	130
† Cabo Quejo	,,	,,	,,	1,747	130
† Crescent	Steel&Iron	,,	British	2,122	180
† Exe	Steel	,,	,,	2,130	250
† Rubens	,,	,,	,,	2,153	250
† Murrumbidgee	,,	,,	,,	2,836	400
† Cragside	,,	,,	,,	1,974	180
† Cabo San Antonio	,,	,,	Foreign	1,747	130

* Compound. † Triple.

By W. Walker, Upper Globe Dry Dock, Rotherhithe.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P N.
Ibis	Wood	Sail	British	110	—

By R. & W. Hawthorn, Leslie & Co., Limited, Hebburn-on-Tyne.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Kinshin Maru	Iron	Steam	Foreign	800	1,860
Le Morbihan	Steel	,,	,,	1,100	1,105
La Vendee	,,	,,	,,	1,100	1,109
Polezini	,,	,,	,,	1,000	329
Prince Potemkin	,,	,,	,,	1,250	715
Port Denison	,,	,,	British	2,700	3,505
Alagoas	,,	,,	Foreign	2,250	1,950

SCOTCH.

By the Grangemouth Dockyard Co., Grangemouth.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
† Rajapuri	Steel	Steam	British	240	70
* Nouvelle Voldrogue	,,	,,	Foreign	310	50
* Mancel	,,	,,	,,	310	50
* Grande Rivière	,,	,,	,,	310	50
Barge	,,	—	,,	70	—
Barge	,,	—	,,	70	—
* Tabasqueno	,,	Steam	,,	420	96

By the Abercorn Shipbuilding Co., Paisley.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Hirondelle	Steel	Steam	For sale	28	25
* General Tajos	Iron	,,	Foreign	80	45
* Argos	,,	,,	,,	80	45
* Drysdale	,,	,,	,,	88	45
† Venus	,,	,,	,,	100	70

By Lobnitz & Co., Slip Dock, Renfrew, N.B.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Alexandre Lavalley	Iron	Steam	Foreign	1,160	440
* Vaillant	,,	,,	,,	160	220
* Vigoureux	,,	,,	,,	160	220
* Resolu	,,	,,	,,	160	220
* Travailleur	,,	,,	,,	160	220
* Abbas	,,	,,	,,	400	300
* Boulak	,,	,,	,,	400	300
* Bourlos	,,	,,	,,	400	300
* Caire	,,	,,	,,	400	300
* Choubrah	,,	,,	,,	400	300
* Damietto	,,	,,	,,	400	300
* Daphne	,,	,,	,,	400	300
* Ennedek	,,	,,	,,	400	300
* Gemileh	,,	,,	,,	400	300
* Gessen	,,	,,	,,	400	300
* Gizeh	,,	,,	,,	400	300
* Mansourah	,,	,,	,,	400	300
* Matarieh	,,	,,	,,	400	300
* Maxamah	,,	,,	,,	400	300
* Memphis	,,	,,	,,	400	300
* Necos	,,	,,	,,	400	300
* Derocheuse	,,	,,	,,	1,200	1,000
* Chaloupe XXIII	Steel	,,	,,	40	65
* Chaloupe XXIV	,,	,,	,,	40	65
* Chaloupe XXV	,,	,,	,,	40	65
* Chaloupe XXVI	,,	,,	,,	40	65
* Chaloupe XXVII	,,	,,	,,	40	65

* Compound. † Triple.

By D. McGill & Co., Irvine, N.B.

Name of Vessel.	Built of	Class.	Owners	G.T. Regis.	H.P. N.
* Sotileza	Steel	Steam	Foreign	111	35
* Galgo, tug.. ..	,,	,,	,,	75	50

By Simons & Co., Renfrew.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
* Esk	Iron	Steam	British	250	220
* Kuphus	Steel	,,	Foreign	1,000	1,200
* St. George	Iron	,,	—	300	250

By Chas. Connell & Co., Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Liddesdale	Steel	Steam	British	2,422	280
† Oronsay ..	,,	,,	,,	2,070	250
Queen Victoria ..	,,	Sail	,,	1,685	—
Helicon	,,	,,	Foreign	1,663	—

By David & Wm. Henderson & Co., Meadowside Works, Patrick, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Bellaura	Steel	Steam	British	2,715	250
† Bellina	,,	,,	,,	2,715	250
† Bellenden	,,	,,	,,	2,715	250
† Rosarian	,,	,,	,,	3,077	350
† Monte Videan ..	,,	,,	,,	3,077	350
Thistle	,,	Cut Yt	,,	100	—
Will o' the Wisp ..	Wood	Cut Yt	,,	17	—

By A. & J. Inglis, Pointhouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Thames	Steel	Steam	British	869	2,300
† Ramapoora.. ..	,,	,,	Foreign	857	2,200
† Karagola	,,	,,	,,	1,168	1,750
† Oonah	,,	,,	Colonial	1,720	2,100

By Ross & Duncan, Whitefield, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* El Mounsef ..	Steel.	Steam	Foreign	6	17
Barge	Galv. Iron	—	British	—	—

By Caird & Co., Greenock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Victoria	Steel	Steam	British	6,268	7,000
† Britannia	,,	,,	,,	6,257	7,000

By Gourlay Bros., & Co., Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Theodora	Steel	Steam	British	477	95
† Dean	,,	,,	,,	1,340	160
† Grebe	,,	,,	,,	814	140
† Fremona	,,	,,	,,	2,900	330

* Compound. † Triple.

By Hall, Russell & Co., York Place, Aberdeen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† St. Sunniva ..	Steel	Steam	British	1,000	250
† Oithona	,,	,,	,,	750	150
* Cruiser	Wood	,,	,,	15	10

By Murray Bros., Dennystown, Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
‡ Forward	Steel	Steam	Foreign	50	50
* Domira	,,	,,	,,	70	60
† Thetis	,,	,,	British	500	650

By Birrell, Stenhouse & Co., Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Benlarig	Iron	Sail	British	1,734	—

By W. B. Thompson, Tay Foundry and Caledonian Shipbuilding Yard, Dundee.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Jubilee	Iron	Screw	British	232	70
† —— §	,,	,,	,,	50	35
King Arthur ..	,,	Sail	,,	1,650	—
† Portland ..	,,	Screw	,,	1,123	300
† Glanmire	,,	,,	,,	1,150	300
† Mamelera 11th § ..	Steel	,,	Spanish	80	45
† Retriever § ..	Iron	,,	British	750	400
† Lyra (Yacht) § ..	—	Steam	,,	—	60
† Albion §	—	,,	,,	—	55
* Shipped to N. York	—	—	—	—	50
† ,, ,, Japan §	—	—	—	—	45
* ,, ,, China ..	—	—	—	—	250
† ,, ,, Abroad §	—	—	—	—	35

By J. M'Kenzie & Co., Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Guillemot ..	Wood	Steam	British	53	17
* Kittiwake	,,	,,	,,	53	17
Josephine	,,	,,	—	—	—

By Scott & Co., Bowling, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Screw Tug ..	Steel	Steam	Foreign	—	—
* Wybia	,,	,,	,,	128	65

By A. Hall & Co., York Street, Aberdeen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Mary	Steel	Steam	British	30	25

By Murdoch & Murray, Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
* Vigilante	Steel	Steam	British	20	60

* Compound. † Triple. ‡ High Pressure

Those Engines marked are W. B. Thompson's Patent.

By S. McKnight & Co., Ayr, N.B.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* George Brown ..	Iron	Steam	British	99	70
* Norfolk	..	..	..	3[illegible]0	70

By Napier, Shanks & Bell, Yoker, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	Tons.	H.P. N.
Four Railway Ferry Boats	Steel	Sail	India	1,650	—

By [illegible] & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Reg.	H.P. N.
[illegible]	Steel	Sail	British	1,772	—
[illegible]	,,	..	,,	1,916	—
* [illegible]	,,	Steam	,,	1,619	180
* [illegible] ..	..	..	..	2,356	250

By Fleming & Ferguson, Paisley.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
[illegible] ..	Steel	Steam	British	240	360

By John Cran & Co., Leith.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
*[illegible] .. .	Steel	Steam	British	38	19
*[illegible]	,,	,,	,,	29	16
[illegible]	Wood	..	Foreign	—	3

By Scott & Co., Kirkcaldy and Abden Shipbuilding Yard, Kinghorn, N.B.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
*[illegible]	Steel	Steam	British	160	250
[illegible]	Iron	,,	Foreign	110	—
[illegible]	,,	,,	,,	—	—

By Barclay, Curle & Co., Limited, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
[illegible]	Iron	Sail	Foreign	205	—
County of Linlithgow	,,	,,	British	2,207	—
[illegible]	Steel	,,	,,	2,058	—

James & John Hay, Kirkintilloch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* [illegible]	Iron	Steam	British	90	15

By James & George Thomson, Clyde Bank, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Reina Regente ..	Steel	Steam	Foreign	5,000	12,000
† Meteor	,,	,,	British	1,250	3,200
† Marathon	..	..	Foreign	1,950	2,400

* Compound. † Triple. ‡ High Pressure. § Quadruple.

By R. Napier & Sons, Lancefield, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P.
† Galatia	Steel	Steam	British	5,000	9,000
† Damascus	,,	,,	,,	3,800	3,000
† Amber	,,	,,	,,	1,050	1,450

By Wm. Denny & Bros., Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
Pukaki	Steel	Steam	Foreign	1,345	750
Buenos Aires	,,	,,	,,	5,195	4,500
Kapurthala	,,	,,	,,	1,122	1,550
Manwyne	,,	,,	,,	674	1,500
Pago	,,	,,	,,	674	1,500
Steel Flat	,,	—	,,	638	—
,, ...	,,	—	,,	638	—
Screw Steamer ..	,,	Steam	,,	83	250

By Alley & MacLellan, Polmadie, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
8 Barges	—	—	Foreign	361	—
Barge	—	—	,,	90	—
4 Barges	—	—	,,	170	—
2 Paddle Steamers ..	—	Steam	,,	1,255	—
Stern Wheel	—	,,	,,	33	—
Twin Screw	—	,,	,,	8·6	—
Screw Launch ..	—	,,	,,	9·47	—
2 Screw Launches ..	—	,,	,,	5·44	—
Screw Launch ..	—	,,	,,	9·7	—
Screw Launch ..	—	,,	,,	4·05	—

By the Ailsa Shipbuilding Co., Troon, N.B.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Herald of Mercy ..	Wood	Sail	British	80	—
* Lady Margaret ..	Steel	Steam	,,	12	25
* Irene	,,	,,	,,	30	50

By Ramage & Ferguson, Leith.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Roodine	Iron	Steam	Foreign	620	125
† Fatshan	Steel	,,	British	2,260	185
† Dotterel	Iron	,,	,,	212	40
† Malikah	,,	,,	,,	330	77
Atlantis	Steel	Sail	,,	50	—
* Chamroen	,,	Steam	,,	420	96

By W. S. Cumming, Blackhill Dock, Parkhead, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Jane	Steel	Lightr	British	36	—
No. 28..	Iron & Steel	,,	,,	27	—
No. 29..	,,	,,	,,	27	—
No. 30..	,,	,,	,,	27	—
Annie	,,	,,	,,	27	—
Isabella	,,	,,	,,	27	—
Barbara	,,	,,	,,	27	—
‡ Arucama	Steel	Steam	Foreign	12	40
Thistle	,,	Lightr	,,	19	—
* Zarceta Primero ..	,,	Steam	,,	30	45
† Aqua-Aerial ..	,,	,,	British	15	60
‡ Garmoyle	,,	,,	,,	60	50
No. 46..	Iron & Steel	Lightr	,,	27	—

* Compound. † Triple. ‡ High-Pressure.

By Russell & Co., Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
Drumcliff	—	Sail	British	2,5[illegible]5	—
Sokoto	—	,,	,,	2,261	—
Clan Buchanan ..	—	,,	,,	2,139	—
London Hill	—	,,	,,	2,139	—
Renee Rickmers ..	—	,,	Foreign	2,134	—
Ayrshire	—	,,	British	1,[illegible]38	—
Elbe	—	,,	,,	1,692	—
Volga	—	,,	,,	1,697	—
Queen Mab	—	,,	,,	1,027	—
Tasso	—	Steam	,,	2,989	1,711
Ariosto	—	,,	,,	2,991	1,634
Electra	—	,,	Foreign	395	610
Adjudante	—	,,	British	213	275
Moovoes	—	,,	,,	159	220
Chester	—	,,	Foreign	2,836	1,300

By Alex. Stephen & Sons, Linthouse, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Queen Victoria ..	Steel	Steam	British	2,427	200
Armadale	Iron	Sail	,,	2,015	—
Bracadale	,,	,,	,,	2,016	—
† Wardha	Steel	Steam	,,	3,917	360
† Elettrico	,,	,,	Foreign	1,246	500
† Warora	,,	,,	British	3,920	360
† Gairloch	,,	,,	,,	2,[illegible]82	220
† Vascongada ..	,,	,,	,,	1,557	170
† Victoria	,,	,,	,,	1,701	170
† Calorio	,,	,,	,,	1,[illegible]34	170

By the Fairfield Shipbuilding & Engineering Co., Limited, Govan, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
* Nederland	Steel	Steam	Foreign	1,677	4,600
* Queen Victoria ..	,,	,,	British	1,568	7,680
* Prince of Wales ..	,,	,,	,,	1,568	7,600
† Lahn	,,	,,	Foreign	5,661	9,3·0
* Empress	,,	,,	British	1,084	6,450
† Devawongse ..	,,	,,	,,	1 670	1,500

By Aitken & Mansel, Whiteinch, Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Mogul	Steel	Steam	British	2,818	380

By McArthur & Co., Abbotswich, Paisley.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
No. 46 (no name) ..	Steel	Steam	—	140	320
No. 47 ,, ..	,,	,,	—	440	450

By Cunliffe & Dunlop, Inch Works, Port Glasgow.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
Pholas..	—	Barge	Foreign	412	340
Rhine	Steel	Steam	British	71	260
2 Barges	,,	—	Foreign	35	—
Stern Wheel	,,	Paddle	,,	100	250
Moselle	,,	Steam	British	71	260

* Compound. † Triple.

By Archibald Macmillan & Son, Dockyard, Dumbarton.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Yarmouth	Steel	Steam	British	1,433	—
Ionia	,,	,,	Foreign	1,481	—
Horace	,,	,,	,,	1,481	—
Albania	,,	,,	,,	1,481	—
Moselle	,,	,,	,,	316	—
Bono[illegible]	,,	,,	,,	100	—
Ital[illegible]e	,,	,,	,,	100	—

IRISH.

By Harland & Wolff, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H. P. I.
† Etolia	Steel	Steam	British	3,139	1,600
† Michigan	,,	,,	,,	4,979	3,200
† Minnesota	,,	,,	,,	3,139	1,600
† Anglesey	,,	,,	,,	9[illegible]0	1,800
† Oceana	,,	,,	,,	6,550	6,500
† Lycia	,,	,,	,,	3 139	1,600
Si[illegible]dia	,,	Sail	,,	3,050	—
† Arcadia	,,	Steam	,,	6,550	6,500
† H.M.S. Serpent ‡ ..	—	—	—	—	4.500
† H.M.S. Racoon ‡ ..	—	—	—	—	4,500

By Workman, Clark & Co., Limited, Spencer Basin, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Star of Victoria ..	Steel	Screw	British	3,239	350
† Harold	Iron	,,	,,	832	98
* Kathleen	,,	,,	,,	336	70
† Corsican	Steel	,,	,,	338	95
§ Clandeboye.. ..	,,	Paddle	,,	295	230
Derby Park	,,	Sail	,,	1 333	—
† ——	,,	Screw	,,	3,271	350

Charles J. Bigger, Londonderry.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
† Foyle	Steel	Steam	British	400	100
* Victoria	,,	,,	,,	40	15
† Lara	Iron	,,	,,	500	150
* Wirral	Steel	,,	,,	80	25
Maiden City	,,	Sail	,,	1,270	—

By McIlwaine, Lewis & Co., Limited, Belfast.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* S.S. Thesis.. ..	Iron	Steam	British	378	60
* S.S. Lough Fisher	Steel & Iron	,,	,,	406	60
Pioneer	Iron	Sail	,,	79	

By Paul Rodgers, Carrickfergus, Ireland.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Patrician	Steel	Sail	British	189	—

* Compound. † Triple. ‡ Engines and Boilers. § Double Diagonal.

AUSTRIAN.

By the Stabilimento Tecnico, Trieste.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Murano	Steel	Steam	Foreign	42	20
† Stefanie	,,	,,	,,	5,060	1,200
* Tiger	,,	,,	,,	1,650	650
* St. Petersburg ..	,,	,,	,,	470	120
* Tugboat, No. 1. ..	Wood	,,	,,	40	20
* Torpedo Boat ..	Steel	,,	,,	100	1400 I.

BELGIUM.

By John Cockerill, Seraing, Hoboken, Antwerp.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Prince Philippe ..	Steel	Steam	Foreign	1,736	750
‡ Vilelde Bruxelles ..	Wood	,,	,,	—	70
* No name	Steel	,,	,,	590	600
‡ Roi des Belges ..	,,	,,	,,	—	70
No name (barge) ..	Iron	—	,,	100	—
,, ..	,,	—	,,	75	—

DANISH.

By Burmeister & Wains, Copenhagen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Sjœlland	Steel	Steam	Foreign	985·33	350
‡ Toldkrydser, No. 3	,,	,,	,,	18	12
† Sonderjylland ..	,,	,,	,,	400	100

DUTCH.

By the Nederlandsche Stoomboot Maatschappy, Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
Kohlewsaur I. ..	Iron	Sail	Foreign	40	—
* Dordrecht	,,	—	,,	70	50
* Dempo	Steel	—	,,	15	200
Gerhard	,,	Sail	,,	400	—
* Reiger	Composite	Steam	,,	130	75
Blücher	Iron	Sail	,,	382	—

By P. Smit, jun., Slikervier, near Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
* Neutraal II. ..	Iron	Steam	Foreign	—	20
‡ Spido	Steel	,,	,,	—	20
* Neptunus	Iron	,,	,,	—	20
‡ Kabouter	,,	,,	,,	—	5
‡ Baby	,,	,,	,,	—	5
† Novelty	,,	,,	,,	—	40
Hendrika	Steel	Sail	,,	—	—

By the Co. de Maas, Delasshaven, near Rotterdam.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
‡ Graaf van Bylandt	Iron	Steam	Foreign	24	12
* Onderwning ..	,,	,,	,,	95	25
* Lucifer	Steel	,,	,,	248	70

FRENCH.

By La Cie Des Messageries Maritimes, La Ciotat.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Manche	Steel	Steam	Foreign	2,228	350

By La Anonyme des Chantiers et Ateliers de la Loire, St. Mazaine.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Vage	Steel	Steam	Foreign	7,000	13,000
† Asival Kornilou ..	Steel & Wd.	,,	,,	9,000	9,000
* Drôme	Steel	,,	,,	2,200	1,100
† Entre-rioi	,,	,,	,,	3,000	1,900
† Santa Fé	,,	,,	,,	,,	,,

By Augustin Normand & Co., Rue de Perry, Le Hâvre.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Goëlo	Wood	Sail	Foreign	40	—
* Bengali	,,	Steam	,,	400	100

By La Ste. Anonyme des Chantiers et Ateliers de la Gironde, Bordeaux.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
6 Torpedo Boats ..	Steel	Steam	Foreign	30	525

FINLAND.

By Wm. Crichton & Co., Aktiebolag, Abo.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
Kolivan	Steel	Steam	Foreign	—	40
Mary	,,	,,	,,	—	15
Elriadne	Wood	,,	,,	—	6
Nowinka	Steel	,,	Unsold	—	10
Gustaf Wasa	Iron	,,	Foreign	—	80
Steam Cutter	Wood	,,	,,	—	5
7 Steam Cutters ..	,,	,,	—	—	2½
5 Steam Cutters ..	Steel	,,	—	—	2½
6 Torpedo Boats ..	,,	,,	Foreign	—	30
Wolna	,,	,,	,,	—	2½
Sibb	,,	,,	,,	—	2½

GERMAN.

By Schiffswerft von Henry Koch, Lübeck.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† s.s. 22	Steel	Steam	Foreign	1,100	500
s. 23	Iron	—	,,	50	—
* s.s. 24	,,	Steam	,,	650	250

By Schiff und Maschinenbau, Actien, Gesellschaft, Kiel

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
* Princess Wilhelm .	Steel	Steam	Foreign	4,300	8,000
† Torpedo Boat ..	,,	,,	,,	89	1,200
† ,, ,, ..	,,	,,	,,	89	1,200

By Rostocker Actien Gesellschaft, Rostock.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P.
* Berthilde	Iron	Steam	Foreign	514	850
Thalia (Barque) ..	,,	Sail	,,	1,469	—
† Oscar	,,	Steam	,,	523	265
† Rival	Steel	,,	,,	584	300
* Dr. Friedrich Witte	Iron	,,	,,	238	160
* Betty (Trawler) ..	,,	,,	,,	140	250
* A Tugboat ..	,,	,,	,,	20	40

* Compound. † Triple. ‡ High Pressure.

By Flensburger, Schiffsbau Gesellschaft, Flensburg.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Lavinia	Iron	Steam	Foreign	1,749	1,100
G. H. Wappaus ..	,,	Sail	,,	1,270	—
† Virgilia	,,	Steam	,,	1,946	1,200
† Frigga	Steel	,,	,,	1,970	1,300
† Daphne	,,	,,	,,	1,966	1,300
† Elsa..	,,	,,	,,	810	360

By George Howaldt, Kiel.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
• Dahlstrom	Steel	Steam	Foreign	68	30
• Bismarck	,,	,,	,,	75	30
• Möwe	,,	,,	,,	26	15
• Schwalbe	,,	,,	,,	26	15
• Libelle	,,	,,	,,	26	15
• Tide	,,	,,	,,	71	30
• Alfred	,,	,,	,,	32	15
160	,,	Sail	,,	96	—
161/162	Iron	,,	,,	120	—
163	Steel	,,	,,	3	—
• 164	,,	Steam	,,	6	6
• 145	,,	,,	For Sale	340	40

By Reiherstieg, Schiffswerfte und Maschinenfabrik, Hamburg.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. N.
† Curityba	Steel	Steam	Foreign	2,730	225

By the Bremer Schiffsbaugesellschaft (formerly H. F. Ulrichs), Vegesack.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H. P. I.
Nixe	Iron	Sail	Foreign	1,719	—
• Floating Crane ..	,,	Steam	,,	—	60
8 Lighters	Steel	—	,,	250	—
2 Lighters	,,	—	,,	180	—
• Werra	,,	Steam	,,	160	200
• Fulda	,,	,,	,,	171	220
• 4 Hopper Barges ..	,,	,,	,,	400	110
• 1 Pumping Dredger	Iron	,,	,,	—	100
• Nipp (Steam Launch)	Steel	,,	,,	12	15

By Gebruder Sachsenberg, Rosslau.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. I.
• Pritzerbe	Iron	Steam	Foreign	140	180
• Fortuna	,,	,,	,,	120	200
• Industrie XIV. ..	,,	,,	,,	380	550
• Patriot	,,	,,	,,	120	200
• Kang-chai ..	,,	,,	,,	100	130
• Sagitta	Steel	,,	,,	16	35
• Deichhauptmann ..	,,	,,	,,	18	40
• Ilmenau	,,	,,	,,	45	70
No. 1. No. 5. ..	Iron	Sail	,,	650	—
† Paul	,,	Steam	,,	45	120
• Preussen	,,	,,	,,	120	200

SWEDISH.

By the Kockums Mekaniska, Werkstad, Malmo.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
• Light-Ship.. ..	Steel	Steam	Foreign	200	40

• Compound. † Triple.

ITALIAN.

By Orlando Bros., Leghorn.

Name of Vessel.	Built of	Class.	Owners.	G. T. Regis.	H.P. N.
• Elena	Steel	Steam	Foreign	69	54
• Rachele	,,	,,	,,	69	54

• Compound.

EXHIBITS OF MESSRS. HULSE & CO. AT THE LATE NEWCASTLE EXHIBITION.

Messrs. Hulse & Co., of the Ordsal Works, Salford, Manchester, had a very fine collection of lathes, machines, and other workshop appliances, to which we have pleasure in referring.

This firm exhibited two lathes of improved construction, viz., a double-geared screw cutting lathe, with independent action for sliding and surfacing, and a hollow spindle lathe for turning,

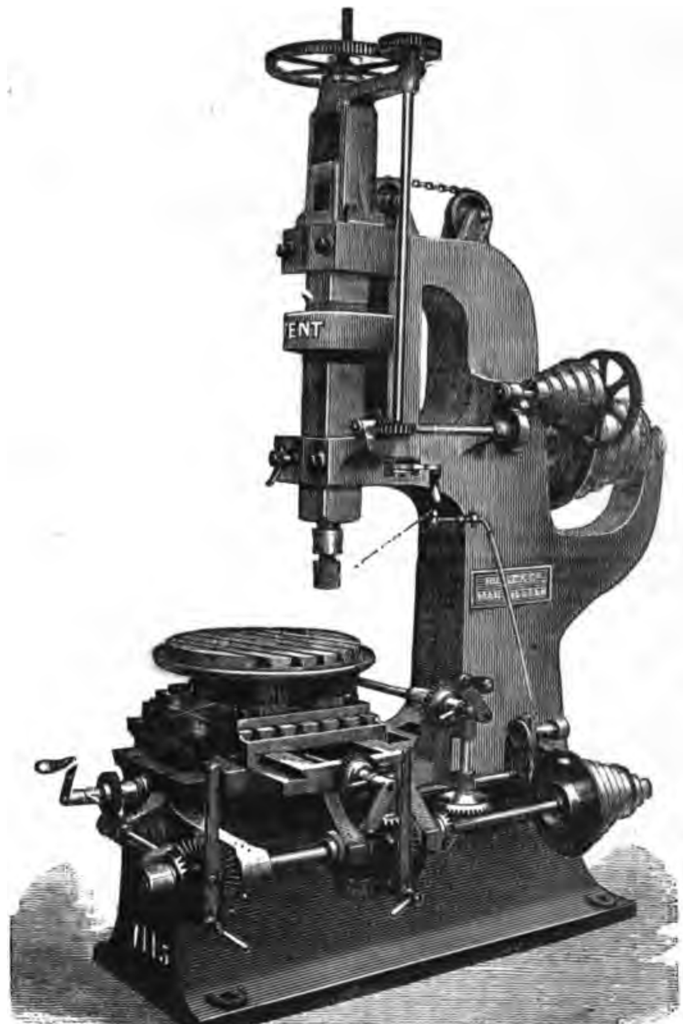


Fig 1.

screwing, and finishing studs, pins, &c., from $\frac{3}{8}$ in. up to $1\frac{1}{4}$ in. diameter, out of long bars. In the former the sliding and surfacing motions are operated by a back shaft driven from the lathe spindle through an independent arrangement of change wheels giving three different speeds; and friction clutches

operated at the front of the sliding carriage, are provided for putting the actions in or out of gear instantaneously. The guide screw, for screw cutting, is inside the bed, where it is well protected, and acts more nearly in the line of the cutting resistance than it would if arranged outside. Reversing mechanism acting on both the back shaft and the guide screw, is applied on the fast head stock, and the slide rest has an action for rapidly drawing the cutting tool back from the work and advancing it again. This lathe has 6 in. centres, and the bed is 6 ft. long.

In the hollow spindle lathe, the bars to be turned, screwed, &c., are passed through the spindle, which is fitted with a concentric chuck for gripping them while being operated on. Immediately each article is completed and cut off, the bar is released and fed forward so as to present a fresh portion to the action of the cutting tools.

Much time and expense is saved by this system as compared with the o d plan of cutting the bars into lengths and then centering each length before putting it into the lathe. The last-mentioned lathe has only one headstock, which is double-geared, and is carried upon a bed formed with a trough for catching the lubricant, and provided with shelves for holding the cutting tools when not in use. A sliding carriage, movable along the bed, either by guide screws or rack and pinion mechanism, at option, holds a capstan rest for six cutters and a screwing apparatus. The several cutters for sliding, ending, chamfering, &c., and the screwing apparatus can be rapidly put in or out of position for operating on the work; and adjustable stops are provided for ensuring exact repetition of diameters and lengths.

tube running in adjustable bearings, and has a variable self-acting screw feed action with an adjustable nut for taking up any end play of the screw, so as to promote steadiness in the cutting action and increase the life of the drills.

The work is secured according to requirement, either on a radial table, having a rising and falling movement, or on the base plate of the machine. The radial table has a slide formed with tee-grooves on top and at one side, which is made extra deep for the purpose; so as to present b th a horizontal and a vertical surface for the attachment of the work. This machine admits work up to 3 ft. in diameter, and appears to be in every detail carefully designed and constructed.

In Fig. 1 we illustrate Messrs. Hulse & Co.'s Patent Vertical Milling and Drilling Machine, which is capable of milling and drilling great varieties of straight and curvilinear work, such as levers, cranks, connecting rod ends, brasses, &c., and also for milling the ends, flanges and ports of cylinders and drilling the stud holes. From our illustration it will be seen to have a rising and falling spindle, which is carried by and rotated within a spin le, so that the main bearing of the spindle is close to a hollow square vertical slide, which rises and falls along with the cutter in all positions. The spindle has a self-acting feed action, similar to that in the vertical drilling machine, just described. The shape and size of the spindle sli le are such that the cutter can operate on surfaces of work which could not be got at by the cutter if an ordinary slide were employed. The table for carrying the work consists of longitudinal and transverse slides surmounted by a rotatory slide, which can be removed so as to allow the work

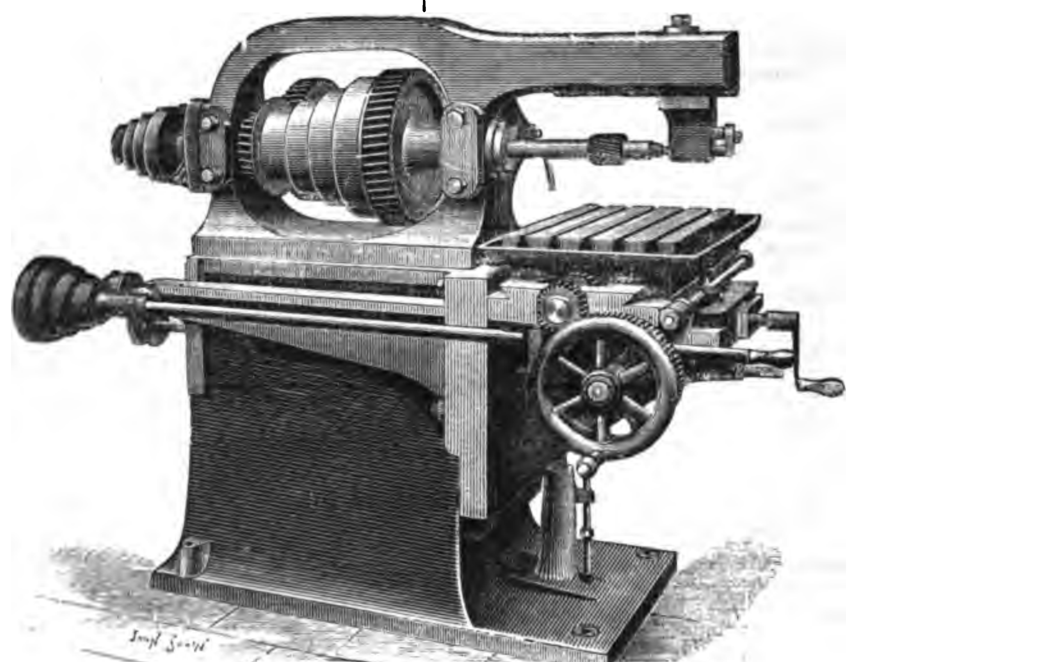


FIG 2.

Messrs Hulse & Co., exhibited a self-acting slotting machine having a four-speed cone driving pulley, with fly-wheel for convenience of adjustment of stroke, and powerful single gearing. The large wheel of the gearing is constructed to act as a counterbalance to the tool slide, which works in a long continuous bearing on the body of the machine. The table consists of longitudinal, transverse and rotary slides, each with independent and variable self-acting feed actions, and a trough for catching the lubricant underneath the rotatory slide. The machine exhibited has a maximum stroke of 8 in. and admits work up to 3 ft. in diameter and 15 in. in height.

One of the finest machines exhibited by Messrs. Hulse & Co., was their Patent Vertical Drilling and Boring Machine. This machine is provided with an improved arrangement of standard and compound driving gear, which allows the driving belt to be worked at any angle likely to occur in practice, without obstructing the space round the machine. The spindle, which is 2 in. in diameter, and has a traverse of 14 in., is rotated by a long

to be fixed to the uppermost of the other two slides when desirable. Each slide has an independent, variable, self-acting feed action, which can be readily applied, reversed, or suspended as required. The lubricant is contained in a cistern in the standard of the machine, and a centrifugal pump is provided for delivering a constant supply of it to the cutter, the surplus lubricant flowing back into the cistern. The machine as illustrated in our Fig. 1, and as exhibited, works up to 30 in. diameter, and 13 in. in height, when the rotatory slide is in position; if the latter be removed, to 19 in. in height.

A machine which cannot be passed over in silence is Messrs. Hulse & Co.'s patent double-geared radial drilling and boring machine. It stands on a bed of box form, tee-grooved on its front and upper surfaces for holding the work, and is provided at the front with a removable rising and falling side table. The driving headstock may be secured either to the back or to the left-hand end of the bed, as may better suit the line shaft of the workshop. The drill spindle is rotated by a long tube, and has a

variable self-acting screw feed action, as in the two last described machines. The machine we are now alluding to commands a radius of from 1 ft. 6 in. to 4 ft. and admits of work 2 ft. in height above the upper surface of the bed and upwards of 4 ft. above the floor line. The drill spindle is 2 in. in diameter, and has 14 in. traverse.

A machine we were particularly pleased with was Messrs. Hulse & Co.'s improved double-geared horizontal milling machine, capable of executing all kinds of straight milling. We illustrate it in Fig. 2. It will be noticed that the headstock has an overhanging arm fitted with a small adjustable poppet head for supporting the outer end of the cutter mandril, and thus giving increased steadiness to the cutting action. All the gearing is machine cut. The table is composed of vertical, longitudinal, and transverse slides, the two latter, each having variable self-acting feed and stop actions. A cistern for the lubricant and a cupboard for tools are formed in the body of the machine, and a small pump is provided for delivering the lubricant to the cutter, the surplus returning to the cistern. The height of the headstock centre is 10 in., the table measures 2 ft. by 14 in., and has a transverse traverse of 2 ft., and 18 in. of longitudinal traverse.

Another useful machine exhibited by Messrs. Hulse & Co. was a universal cutter grinding machine. It has been specially constructed for grinding to a keen cutting edge the teeth of face and edge milling cutters, parallel or taper reamers with straight or spiral flutes, and other similar cutters after they are hardened and tempered. The grinding is effected by a high-speed emery wheel, the work being acted on by *one of the sides of the wheel, instead of by its edges* as is usually done. The system has several advantages, as, for, instance avoiding the grinding of work into wavy forms, and that it allows the use of comparatively large emery wheels in grinding cutters having finely pitched teeth. At the outer end of the spindle of the machine is another emery wheel for general grinding purposes, an adjustable tee rest being provided for supporting the work. The last mentioned machine is capable of operating on milling cutters, reamers, &c., up to 6 in. diameter and 9 in. long.

Among the remaining exhibits of Messrs. Hulse & Co., we noticed special patent spirit levels, and Gavin Jones' patent swivel tool holders. In the last mentioned the cutter can be taken out for grinding, and be replaced without disturbing the adjustment of the swivel, and in which the swivel can be adjusted without disturbing the adjustment of the cutter.

Pipe screwing apparatus, surface plates, &c., are also exhibited on Messrs. Hulse & Co.'s stand; which was in its department, one of the best in the exhibition.

TORPEDO VESSELS.

IT has long been manifest that the lightly-built and extremely high-speed torpedo boats, which have been hitherto the *beau ideal* of the British and foreign navies, are on the one hand lacking in important essentials, as a means of defending harbours and coasts, and are too long and cumbersome to be carried on board armour-clads or other sea-going war vessels, for operating in a sea fight.

At the present time there is a lull in torpedo-boat building on the Thames, due apparently to the Admiralty having decided to enter upon a different policy with regard to the character of these craft. That this is so appears to be evident from a statement recently placed before Parliament by the Admiralty, from which we extract the following: "The Board have carefully considered the types and dimensions of the torpedo boats which experience and experiment have shown to be best adapted for sea service or harbour defence. The practical tests, during recent evolutions, imposed upon first-class torpedo boats—that is, boats intended for open sea service, and upwards of 100 ft. in length—have shown that they could not, in actual warfare, stand the strain of the daily wear and tear to which they might be exposed. The discomfort and hardships which their crews have to endure in rough weather; the loss of speed to which, after steaming a certain number of hours, at full pressure, they are subject, owing to the tendency of their necessarily contracted boiler tubes to choke, disqualify boats of these dimensions from taking the prominent part in warfare in the open sea which their adherents claimed for them. The Board have, therefore, decided in future to build, for sea-going purposes, vessels of larger dimensions, capable of acting both on the offensive and defensive in torpedo warfare in the open sea." Further on it is also stated: "The Board have decided upon adopting a new type of second-class torpedo boat, capable of being lifted on board ships of a certain displacement, and which would be carried by the ships for service in the place of the larger or first-class torpedo boats which are now supposed to accompany a squadron."

It would almost appear as if the Defence Vessel Construction Company, Limited, whose works are at Erith, on the Thames, had divined this decision of the Admiralty, as they have already constructed a vessel, which, we believe, will be found to fulfil this new, and in our opinion, highly proper requirements of the Admiralty, for a first-class torpedo-boat. Before noticing the craft particularly, we desire to offer a suggestion to the Admiralty authorities regarding second-class torpedo boats, viz., that they should be submarine vessels, *i.e.*, capable of being temporarily submerged. For the purpose of attacking an adversary's fleet lying at anchor close in shore, protected by shore batteries and under similar circumstances, a torpedo-boat about 30 ft. to 40 ft. long which could be submerged for one or two hours would often prove invaluable. It is, therefore, our opinion, that before deciding to build any additional second-class torpedo boats, the Admiralty should invite each of the various patentees of "submarine" vessels to construct a craft after their own ideas, but limited in length to 40 ft. Let 'stored steam" be tried against "electricity" and against steam raised by the "soda process." A moderate speed under water would suffice, say 8 knots. Whichever craft gave the greatest security against breakdowns, &c., and was capable of keeping on her "course" under water when steering by the compass, should then be selected as the "typical" second-class torpedo boat.

To return, however, to the torpedo vessel that has been built at Erith, and has been engined and boilered by Messrs. Ernest Scott and Co., of Newcastle-on-Tyne, the vessel is 182 ft. long, 20 ft. beam, with a draught of about 7 ft. 6 in. The hull is built entirely of steel, and is of novel appearance, due to the fact that it is covered in from stem to stern with a bullet-proof steel superstructure, the object being to give a measure of protection to the crew when they are working the guns or torpedoes, which are worked from the main deck.

The machinery is carried below the water line, and consists of a twin pair of triple-expansion engines, working at a high speed, driving two screw propellers, and all the parts of each engine, including shafting, &c., are exact duplicates, so that in the event of a breakdown there shall be every practical chance of reaching port. The boilers are two in number, of the locomotive type, and the largest yet built, particulars of which are withheld. In connection with them, to ensure fresh-water feed, two of Rayner's Volute Condensers are fitted. It is anticipated in some quarters that this apparatus, which is very light, will come into general use, in the early future, for preparing the feed water of boilers having a high working pressure. The sole makers and licencees are Messrs. Ernest Scott & Co., and we hope in an early number to fully illustrate and describe it.

Forced draught is employed in this new torpedo vessel, on the closed stokehold system, by means of two fans and engines, the fans being constructed of gun-metal, cast in one piece, and then machined all over.

They are very light, and having ample bearing surface, with an efficient system of lubrication, can be run at extremely high speeds.

The hull of the vessel is divided into several water-tight compartments, with complete pumping arrangements. Should any one compartment be damaged, all the pumping power can be exerted in emptying it.

The steering, when in action, is effected by means of a steam steering gear, worked from a shot-proof conning tower, while under other circumstances, a hand steering gear placed on the upper deck is available. The armament, considering the size of the craft, is formidable, consisting of a number of 6 pounder Hotchkiss guns, four-barrelled Nordenfelt guns, and four torpedo tubes. One of the latter are placed at the bow, another at the stern, and the remainder amidships. An electric search light is provided, and the whole of the craft is fitted with electric lighting arrangements. Ample store-rooms, water-tanks, magazines, crew's quarters and coal bunkers, are provided, as the vessel is intended to be capable of acting independently and steam long distances without re-coaling or re-provisioning. Similarly to the light torpedo cruiser described on page 97 of the June number of the "Marine Engineer," the torpedo boat built by the Defence Vessel Construction Company, Limited, has a powerful ram bow, and altogether it is evident that in this craft a new departure is being made. It can hardly be anticipated that this vessel shall attain the maximum speeds of lighter-built craft, but her sea-going qualities will fully compensate for any deficiency in speed, which however, is expected to be very satisfactory. Probably in our next number we shall be able to give the trial trip results.

CLYDE SHIPBUILDING.

MR. LEONARD GOW delivered the first of a series of addresses to the members of the Clyde Steam and Sailing Ship Associations, in the Philosophical Society Rooms, Glasgow, last month. Mr. Cuthbert, president of the Clyde Steamship Association, occupied the chair. Mr. Gow took for his subject "The Rise, Progress, and Prospects of Clyde Shipbuilding."

Mr Gow, in the course of his address, said that it was in 1764 that James Watt made his first model of a steam engine, and in 1812 Henry Bell, of Helensburgh, with his little vessel, the *Comet*, was the first who practically and successfully applied steam to navigation. Not successfully in a pecuniary sense; for his invention, which so largely benefited the human race, never brought wealth to himself. In his declining years his chief support was an annuity of £50 granted to him by the Clyde Trustees. The *Comet*—so called because she was launched in the same year that a brilliant comet appeared in the north of our horizon—was designed and constructed by Mr. John Wood, of Port Glasgow. She was 40 ft. in length and 11½ ft. beam. Her engine and boiler, which cost £192, were 6 H.P., and her draught 4 ft. In ordinarily favourable conditions of wind and tide she attained a speed of 7½ knots. Mr. Bell ran her for a short time between Glasgow and Greenock, but unremuneratively—chiefly on account of the prejudice raised against steam navigation by rival interests. Among the skippers none regarded the project with more inveterate hostility than the Highland gabert men, who recommended their craft to the public as sailing the "Almighty's wun"—that (pointing to the *Comet*) by the "teevil's wun." He afterwards employed her on the coast of Scotland and Ireland—sometimes taking a cruise to England when weather permitting. Her days were ended by being wrecked near Craignish. Her engine is preserved as an object of interest in the Patent Museum, London. In a few years numerous passenger steamers were running on the Clyde between Glasgow and Greenock—some of them going as far as Rothesay, and even Campbeltown. The fare to Greenock was 4s., to Rothesay 7s., now 1s. and 1s. 6d. Mr. David Napier, who made the boiler for the *Comet*, was cousin and brother-in-law to the more celebrated Napier of Shandon. He was one of the earliest of those in this country engaged in marine engineering, and seems altogether to have been a man of extraordinary energy and ability. In 1818 he launched the *Rob Roy* from the yard of Mr. William Denny, of Dumbarton, father of Mr. Peter Denny. She was 90 tons register and 30 H.P. She was the first sea-going steamer, and traded between Glasgow and Belfast, carrying the mails with great punctuality for two consecutive years without requiring any repairs. In 1818 also the first iron vessel was built by Thomas Wilson at Faskine, on the banks of the Monkland Canal, 11 miles from Glasgow. She was appropriately named the *Vulcan*, was 65 ft. in length, 11 ft. broad, and carried 150 passengers, with their baggage on a draught of 4 ft. Ten years ago she was still in existence carrying minerals on the Forth and Clyde Canal, and may be in existence still.

Mr. Gow then entered on a series of interesting biographical sketches of the various eminent men whose names are associated with the records and triumphs of marine engineering and shipbuilding on the Clyde—Napier, Burns, Wingate, Steele, Caird, Duncan, Denny, Barclay, Randolph. Elder, Pearce, Tod, M Gr gor, Thomson, Inglis, Kirk, and Hamilton.

As regards the extent of Glasgow and Greenock tonnage, Mr. Gow said:—In 1810 there were only 24 ships on the Glasgow register, with a total tonnage of 1,956 tons. Fifty-one years later there were 679 ships, with a tonnage of 145,684 tons. Year by year the aggregate kept steadily increasing, till at the end of last year the nett tonnage on the Glasgow register was 1,062,395—483,862 being sailing, and 578 533 steam tonnage. In gross tonnage it amounts to 1,362,660, and by reckoning the additional work steamers can do, as compared with sailers, the effective tonnage is equal to 3,117,000; the value in money, even in these times, cannot be less than 20 millions sterling. It is one-tenth of the whole tonnage of Great Britain. It is equal to a half the tonnage of the United States. It is not far behind the whole tonnage of Germany, and it exceeds the whole tonnage of France by 38,000 tons. By adding the registered tonnage of the port of Greenock 155,354 tons sailing, and 72,798 steam—to the Glasgow tonnage, it gives us a great total of 1,290,547 nett register tons, being only 134,244 short of Germany, and 261,100 in excess of France; the gross effective tonnage being 3½ million tons. Glasgow and Greenock thus own over 14 per cent., or nearly a seventh of the whole tonnage of Great Britain.

Referring to the future prospects of the shipbuilding trade, Mr. Gow opined that when the revival comes the Clyde will always secure the large share. This she will do for two reasons. First, from the wide and varied range of shipping she produces. For example, out of 138 steamers, of 4,000 tons and upwards, now in existence—and nearly all of them of the highest types of ships—the Clyde built 79, or nearly 60 per cent. In addition to this, the Clyde has always had her fair share of all the ordinary types of vessels built, and it is really upon these latter that the majority of shipbuilders depend. To the perfecting, therefore, of this class of tonnage our shipbuilders should give their especial attention, or they may find the Tyne and the Wear become even more successful competitors than they have been. The other ships of the more elaborate or novel type will come to us as hitherto. Then, secondly, the majority of orders will continue to flow to the Clyde because of the high and unrivalled reputation of her builders. There can be no doubt as to the superior quality of the work done, and they are all Clyde men who have brought the marine engine to its present state of perfection.

A vote of thanks to Mr. Gow for his interesting address was cordially given.

MARINE ENGINEERS' UNION.

A BRANCH of the Marine Engineers' Union was opened at 15, East India Road, Poplar, E., on the evening of Friday, the 2nd December, by Mr. F. W. Shorey, the hon. secretary. The formal business was the election of a committee of management, whereof Mr. Henry Prior, chief, Mr. H. P. Sherlock, second, and Mr. S. J. Tyler, third, were the nominees, these gentlemen being then at sea. Further, the provisional honorary secretaryship of Mr. F. W. Shorey was confirmed, and Mr. H. Dodridge appointed assistant secretary. The attendance was considerable. Mr. Shorey, in opening the proceedings, stated that the premises had been acquired by purchase for the Union, and being situated on the main tramway thoroughfare to and from the entire system of the up river London docks, he thought they could not fail to prove a convenience and comfort to members with homes in the outports, whose occupation or pleasure brought them to London. The premises, in addition to comprising the commodious room in which they were then assembled, possessed an excellent smoke room down stairs, as well as kitchen, and upstairs there was a committee room and reading room. Still higher up, sleeping accommodation was being provided to a moderate extent. Presently a billiard room would be erected on the vacant ground behind, and with that furnished, a veritable club-house and home would be provided, which would be found sweet and clean from top to bottom, the whole having been overhauled, as they could see for themselves, and an attempt made at decoration. Personally, he was proud of the building and the occasion, and he felt certain that it would be a gratification to the large number of gentlemen present to be told the position of the Union at the present time. The enrolled members of the Poplar branch was 93. Had a little push been made, the even number of 100 would easily have been secured, but everything considered, it was better to lead than to drive in unionism as in other things. In these days of scant employment, lower wages, and technical education, when men of all occupations and conditions had to fight hard for their own hands, the marine engineer was not likely to be backward. The Union at large now possessed 1,100 members, and he might add, that by the end of March, the number would probably not fall short of 2,000. What the eventual number would be he would not like to say, but were it not to exceed 2,000, such a number of united voices, making representations to the Board of Trade, and being represented by deputations to the Board of Trade, would carry just two thousand times more weight than the voice of any individual marine engineer. All that the Union wanted was fair play and a better recognition of their position as a body of educated scientific men than was accorded to them at the present time.

Mr. Dodridge, the assistant secretary, on being called upon for a statement of his experience at Antwerp and elsewhere, furnished some interesting details as to the present aims of the Union. The progress at Antwerp, as at Rotterdam, Hamburg, Bordeaux, and Bilboa was, he said, encouraging. There was no hesitation in coming forward to join, the terms of membership being so easy, and the general hope expressed was that this time a real and permanent embodiment of the class would be effected on broad principles. To the programme which is to be submitted to the Union for consideration, there so far had been no dissent, nor could there be any, as it was open both to amendment and addition. With their permission he would place the points before them. 1. All steamers, whether in the passenger or cargo

trades, to be periodically surveyed by the Board of Trade. 2. Nominal H.P. to be fixed by measurement by the Board of Trade. 3. Every steamer to have a certificated engineer in charge. 4. No one to take charge of a watch without an engineer's certificate. 5. No one to take charge of any steam boiler unless he had an engineer's or a driver's license. 6. Certificates to be extra, first, second, and third. 7. Licenses to be granted to engine drivers. 8. Third class certificates to be granted after five years' apprenticeship to marine engine builder or repairer, or one year's service on articles as engineer, or apprenticeship as mechanic, millwright, blacksmith, or boilermaker, followed by three years as improver in marine shop, and one year on articles as engineer. 9. Second class certificates to be granted after two years' service on articles as engineer, with third certificate. 10. First class certificates to be granted after two years' service on articles as engineer, with second certificate, of which at least one year as second in any steamer. 11. Extra certificates to be granted as now. 12. Engine driver's license to be granted after four years' service on articles as fireman or greaser, and passing examination by any extra or first engineer. This examination to be reported to the Board of Trade, and the fee to be 5s. 13. Articles to state voyage as between two ports N. and S., and two ports, E. and W. 14. Engineers in charge of steamers to select and sign on all hands in his department. 15. Engineers in charge of steamers to keep official log, and to produce same to shipping master when voyage or running agreement ends. Mr. Dodridge was followed by Mr. Leask, who congratulated the meeting on the successful opening and the unanimity which prevailed. A string band was then brought into requisition, and with cake, tea, coffee, and cigars, a pleasant *conversazione* was maintained until the elders thought it was getting late.

AN ENGINEER'S YARN.

BY ONE OF THE CLOTH.

IT was in the s.s. *Kangaroo*, I sailed for a foreign clime,
 On a date which shall be known to you as "once upon a time."
Now each of the mates and skipper had, strange as it may seem,
Been polishing up their figures, and had gone and passed in Steam;
While I and the other engineers, all hot with emulation,
And stung by the skipper's jibes and jeers, got passed in Navigation.
Now the skipper and I in a general way got on very well together,
For we'd shipmates been for five long years in every sort of weather;
But he was a curious sort of cuss, and possessed a powerful notion,
That he knew enough of Mechanics to discover Perpetual Motion;
While as for Engineering, why to guess by the yarns he told,
He'd been driving a triple-expansion before he was ten years old.
As for me, I was somewhat nettled, at this exaggeration,
So to be as big a liar as he, I bragged of Navigation—
How many a night on the wave-swept bridge, when the howling tempests blew,
I had conned and steered on her nor'-east course the ship and her gallant crew.
So we nagged and nagged and lied and bragged, till—"I'll tell you what," says he,
"We'll never settle anything by argument, d'ye see;
You take the bridge and keep her course, and take your crowd as well,
And I and the mates will go below—we'll make those engines yell."
"Agreed, agreed! a grand idea! the best I've heard of yet;
I'll keep this packet on her course, and steer her straight, you bet!"
So skipper and I went down below, when I showed him a thing or two—
The donkey checks and the extra feed, we passed them in review;
The swabbing tins, and all the rest, but he got in quite a huff—
"Get you on deck," says he to me, "I'll manage her right enough."
So up I went to the flying bridge, where the second was in full charge,
Enjoying himself in the sunlight, for the day was fine and large.
Says I, "Now steer N.E. by E. across the foaming tide,
And look out sharp for the Bunkum rocks ahead on the starboard side."
Then down I went for an hour or so, as I thought I deserved a spell,
And slept like a top, and arose refreshed, at the clang of the quarter bell.
The sea was smooth, but a sort of a mist was hanging about ahead,
And of all the dangers of the deep a fog is the one I dread.
As I passed the door of the engine-room, the sounds I then did hear,
Would have paralysed a Paladin, and filled his heart with fear;
For the rods and valves were shrieking like fiends at the whipping post,
While the stink of the heated bearings would have poisoned Hamlet's ghost.
Amidst the uproar down below, it made my heart go thump,
When the skipper yelled to his wretched mate that the bilge-pump wouldn't pump!
However, away I went to the bridge as the mist was closing round,
Till it got so thick that presently I deemed it wise to sound:
Which I did, and got ten fathoms, and presently nine or so.
As it's thick, and the water's shallow, why I guess I'd better slow.
So I put the telegraph over; but the din which arose when I
Got the pointer fair on the signal would have rent the very sky.
The fog closed in, and just ahead, I thought I heard a bell,
So I sent a man to the whistle cord at intervals to yell.
I was fretting about the engines, and knew I could safely swear
That things weren't going right below, although I wasn't there.
I was meditating stopping, for my wits were all abroad,
When—no need to ring the telegraph—she stopped of her own accord!
So down rushed I to the engine-room, full of foreboding fears,
Where the sights and smells which met me would have moved a man to tears.
The bilges were full of water, the boilers were nearly dry,
The low pressed rod was black as ink, and ditto was the high;
The bearings they were blazing hot, the pins, oh! Julius Cæsar!
They'd been trying to drive the engines, but had never thought to grease her!
So I chased the lot away on deck, and yelled like one insane,
And got the pins and bearings cooled and boilers filled again;
The bilge-pumps next I got to work to chuck it out full bore,
And soon the fog cleared off and we were going full speed once more.
So you may safely bet your boots from now till crack of doom,
No mate nor skipper passed in Steam takes charge of my engine-room.
While as for the Navigation, it's all very well in its way,
But as different from practical seamanship as night is apart from day.
No navigating job for me: I'll frankly, freely own,
I'll keep my engines up to the mark, but—I'll leave the bridge alone.
CRANK PIN.

LONDON ASSOCIATION OF FOREMEN ENGINEERS AND DRAUGHTSMEN.—The usual monthly meeting of this Association was held on Saturday, the 3rd ult., at the Cannon Street Hotel. After the private business of the Association was concluded, Mr. Hitt gave a description of his new (*sic*) method of propelling ships by a combination of sail and paddle, and exhibited models of ships with his apparatus attached. The leading features of this invention consist in making the hull of the ship with a water passage up the centre, somewhat similar to the twin steamers which have been used at different times with a large paddle-wheel in the centre. Instead of the usual paddle-wheel driven by steam engines Mr. Hitt introduces a large wheel constructed with arms or vanes somewhat similar to those of a windmill. The whole surface of this wheel above the deck is exposed to the action of the wind, which causes it to revolve, and the ends of the vanes which go down into the wheel race lay hold of the water and propel the ship forward, at least Mr. Hitt says they do. After this a paper was read by Mr. W. T. Coates on "Heat and Work."

STEAM TUG BOAT FOR THE VOLGA.—Notwithstanding the low freights current last navigation on the Volga a great deal of capital continues to be sunk in fresh steamers and barges. One of the more energetic of the Nijni Novgorod steamboat owners, Gordei Chernoff, has commenced building a boat, with engines designed to indicate 2,400 H.P., intended to tow up barges laden with masouta, that is, naphtha residue, from Astrakhan to Nijni Novgorod. The engines are already commenced, to the designs of V. Kalasknikoff, parts being ordered at several different works. The engines will be triple compound, three cylinders, one 38 in., one 54 in., and one 80 in.; stroke, 8 ft.; three cranks at 120 deg.; crank shaft, 16½ in. in diameter. Four double furnace return tube boilers, fitted to use masouta as fuel, with a total heating surface of 7,500 square ft., will be made of Russian ⅞ in. plates; working pressure 120 lbs.; paddle wheels to be feathering. The hull will have the following dimensions:—Breadth, 37 ft.; length on water line, 245 ft.; depth, 12 ft. 6 in.; draught with water in boilers and fuel on board, 3 ft. 6 in.; estimated displacement, 630 tons. The tug ought to tow up the Volga one million poods, that is about 16,500 tons, of masouta in bulk in eight barges at about three miles an hour, against stream.

MESSRS. KENDALL AND GENT'S EXHIBITS AT THE LATE MANCHESTER EXHIBITION.

MESSRS. KENDALL & GENT, of the Victoria Works, Manchester, had a very fine display of machines, such as lathes, screwing, drilling and tapping machines, tool holders, &c., but the limits of our space preclude a description of the whole of their exhibits. We, however, illustrate and describe those which are most novel.

Fig. 1 shows a special brass-finisher's turret lathe which has been specially designed for boring, turning, facing and screwing. The headstock has a steel spindle running in hardened conical bearings, and is mounted on a short bed, carrying also a sliding carriage, with transverse slide and turret rest. It is also provided with an improved arrangement for instantly setting it to a given angle for turning, boring, or chasing taper work.

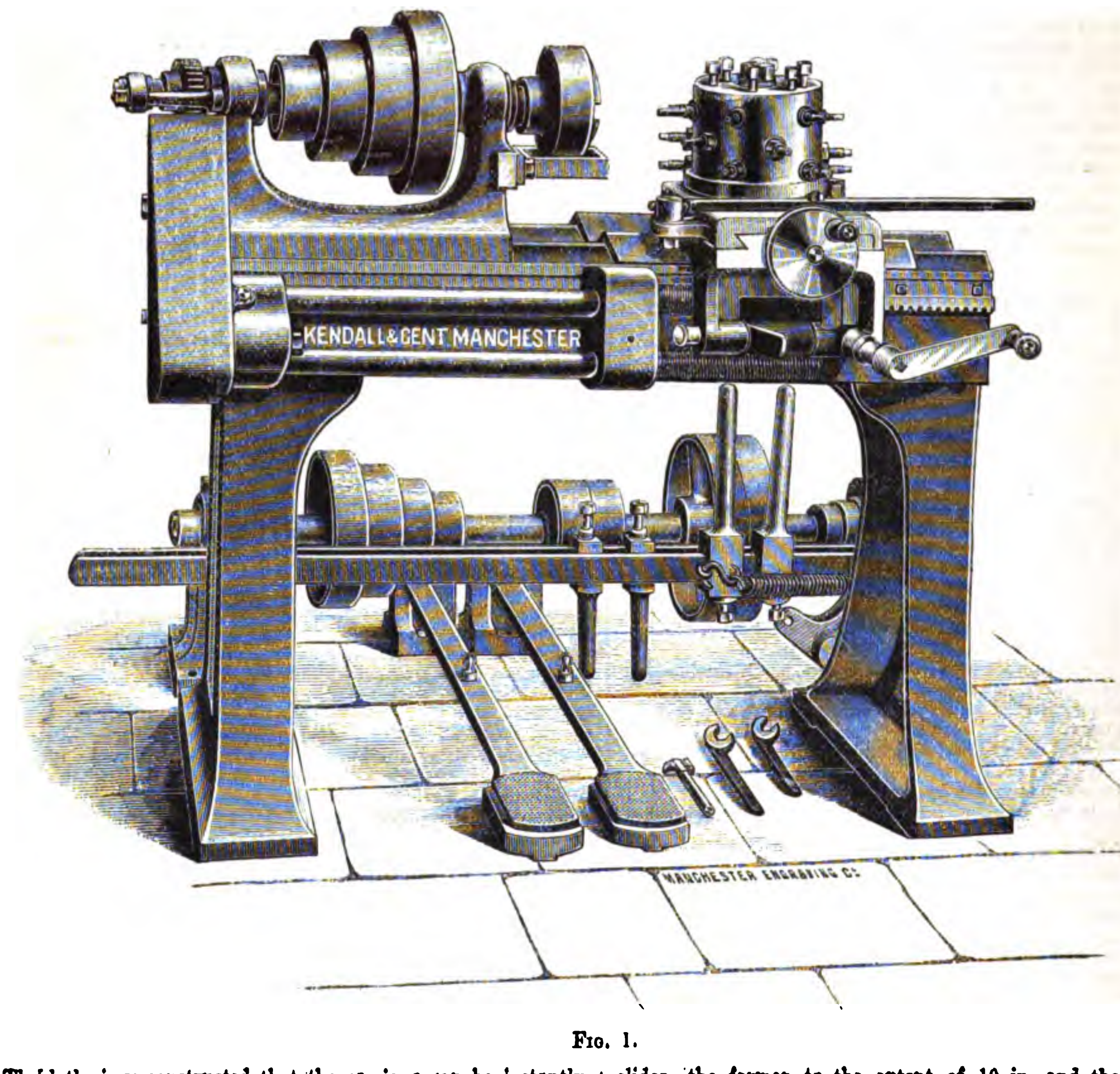


FIG. 1.

The lathe is so constructed that the carriage can be instantly actuated by either of two guide screws of different pitches, so that where an object has two different threads upon it, as in stuffing boxes, these can both be screwed accurately at one chucking of the work and without any loss of time in changing the lathe. The carriage has a quick hand movement by rack and pinion.

The turret rest is so arranged that by a single movement of a hand lever the turret is unlocked, turned round for the next tool, and locked ready for immediate operation. Beneath the tools are two series of stops, forming a pair for each tool, one of which regulates accurately the diameter of the part turned or screwed by each tool, and the other the length. These stops being fixed in the turret, every movement which brings a tool into position brings also its own corresponding pair of stops.

The lathe is supplied with one improved concentric jaw chuck to admit 2 in. in diameter tools, guide screws and complete top-driving apparatus, so arranged that the lathe can run in either direction or be stopped by simple foot levers.

In Fig. 2 we illustrate Messrs. Kendall & Gent's Improved Universal Milling Machine, which they have designed so as to combine the principles of the American Universal Milling Machine, with the more rigid and substantial method of English machine construction, and especially to apply to general work the principles so successful in light machinery.

These machines are made in three sizes the smallest size being single geared, and the larger ones double geared. Our illustration is taken from the largest size, and it will be noticed the main frame, carrying the headstock, has a vertical slide in front, which is fitted with tables having both longitudinal and transverse slides, the former to the extent of 10 in. and the latter for 2 ft. 6 in. An improved adjustable overhead support is provided for the end of cutter mandril, which can be easily removed when not required. The transverse slide is arranged to swivel to any required angle, and is provided with a simple self-acting feed motion, effective at all angles, and having an automatic stop motion. The table is raised and lowered by a handle in front of the machine, having an index plate for fine adjustment, and is supported in the centre by a screw and pillar, being also provided with four bolts, sliding in planed T slots, for *rigidly* fixing the slide to the face of the main frame when the work is set, this

method of construction giving great rigidity to the table. These machines have the tables fitted in each instance with an improved universal headstock, which has a hollow spindle for carrying chucks, centres, drivers, &c., which can be set to any angle in the vertical plane and also fitted with a worm wheel and dividing plate for giving the required number of grooves in an object; and when cutting spiral grooves, this spindle is rotated from the feed screw by suitable change-wheels, which are supplied; as well as one universal chuck for fitting the spindle nose of headstock; two adjustable headstocks for carrying the opposite end of objects between centres, one fitted with centre for parallel work, and the other with adjustable centre for taper work; complete top-driving apparatus, having two sets of pulleys, and all necessary screw-keys.

The machine we illustrate in Fig. 2 is very strong, and specially adapted for heavy cutting in wrought iron and steel, such as required by marine engineers, and as will be gathered from our description, is capable of cutting twist drills, rymers, &c., with either straight or spiral grooves, as well as spur, bevel, worm, and scroll wheels, in addition to plain milling work. When required, the dividing headstocks are fitted with Scott's patent dividing apparatus, by which any desired number of grooves or divisions, whether odd or even, can be obtained.

Another machine which attracted our attention at Messrs. Kendall & Gent's stand is illustrated in Fig. 3. This is a machine specially adapted for making these circular steel cutters of any desired section for milling machines, wheel-cutting machines, &c., and is so constructed that all the teeth of the cutter are made of exactly the same shape, and finished completely without requiring any backing off or filing whatever. The blank *roughly* turned to the section, is placed on a mandril carrying a suitable dividing-plate, and a small milling cutter, driven by gearing and pulleys, is carried by compensating hand levers. The action of the small milling cutter upon the blank is controlled by a former of the same pattern as the cutter required, and by this means cutters having either *curved* or straight faces can be finished completely. It is adapted for making cutters up to 5 in. diameter, and is usually fitted with an ordinary dividing plate fixed on the mandril, as shown in our illustration, having suitable divisions on the periphery for ordinary cutters; but when required for making cutters with *any* given number of teeth, it is fitted with Scott's patent dividing apparatus. It will be noticed that Fig. 3 shows this machine with an independent cast-iron stand; it can, however, be obtained of suitable form for fixing on a bench, and is always supplied with a sample milling cutter, screw-keys, &c.

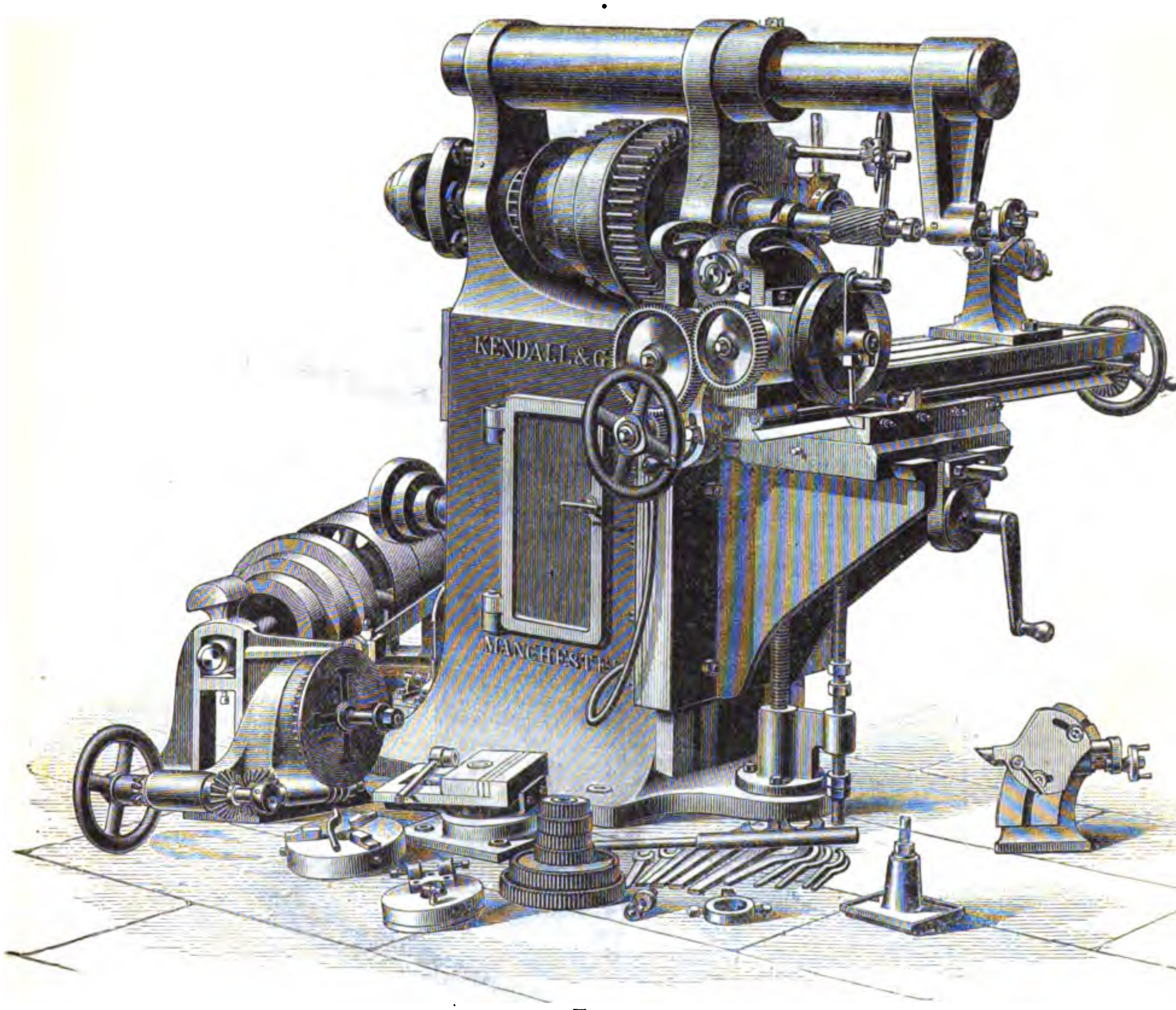


Fig. 2.

Messrs. Kendall & Gent also exhibited an improved cutter grinding machine, which we illustrate in Fig. 4. It is specially adapted for grinding the various kind of cutters used in milling work, with the greatest accuracy, so that the correct cutting angle is retained on the teeth whilst they are being ground perfectly true with the central hole for the mandril. This is accomplished by using a small emery wheel, running at a high velocity,

and having the milling cutter so mounted as to be able to bring each cutting head in succession under the emery wheel. As the same operation is performed on each tooth of the milling cutter, they are thus made perfectly concentric with the central hole, enabling every tooth of the cutter, when at work, to take the same uniform depth of cut. Either straight or conical milling cutters, with teeth cut on the edge or face, can be accurately ground, whether the grooves are straight or spiral.

As will be seen from our illustration, Fig. 4, the emery wheel is mounted on a spindle carried by a small headstock on the top of a vertical stand, and capable of being swivelled to any angle. The cutter is mounted on a mandril, carried by a bracket mounted on a table with compound slides, which are traversed when grinding

The cutter being ground, turns freely upon its mandril, and, in order that each tooth can be ground quite independently of the other a finger guide is attached by universal jointed rods to the side of the machine. The front edge of each tooth of the cutter is pressed against this finger, which thus follows the curvature of the groove, thereby enabling spiral or straight-grooved cutters to be rapidly ground. By means of an additional appliance shown on the floor in our illustration (Fig. 4), cutters with semi-circular edges or rounder corners can be ground. The machine is supplied with driving apparatus, screw keys, mandrils and emery wheels.

Although the illustrations and descriptions of Messrs. Kendall and Gent's latest machines have taken up more space than we can

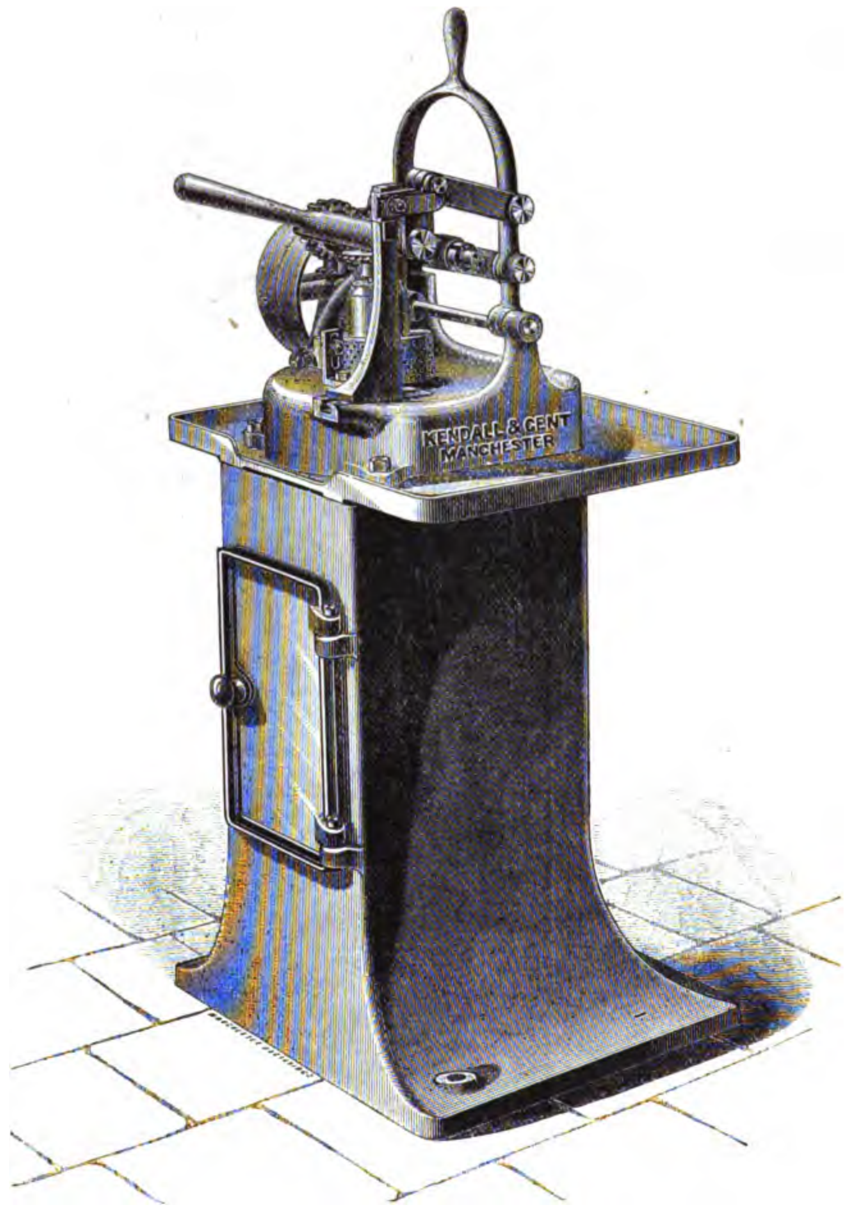


FIG. 3.

by a hand lever, the transverse slide being adjustable by the screw for setting the cutter. This mandril is capable of being swivelled to any angle in a vertical plane by a small worm and wheel for grinding conical or face cutters. The table can be adjusted vertically by screw and hand wheel conveniently placed at the side of the machine.

well spare, we must not omit to award at least a word of praise for the excellent workmanship and material manifest in all their exhibits. As to the capabilities of this firm in designing machinery, the machines alone speak very forcibly.

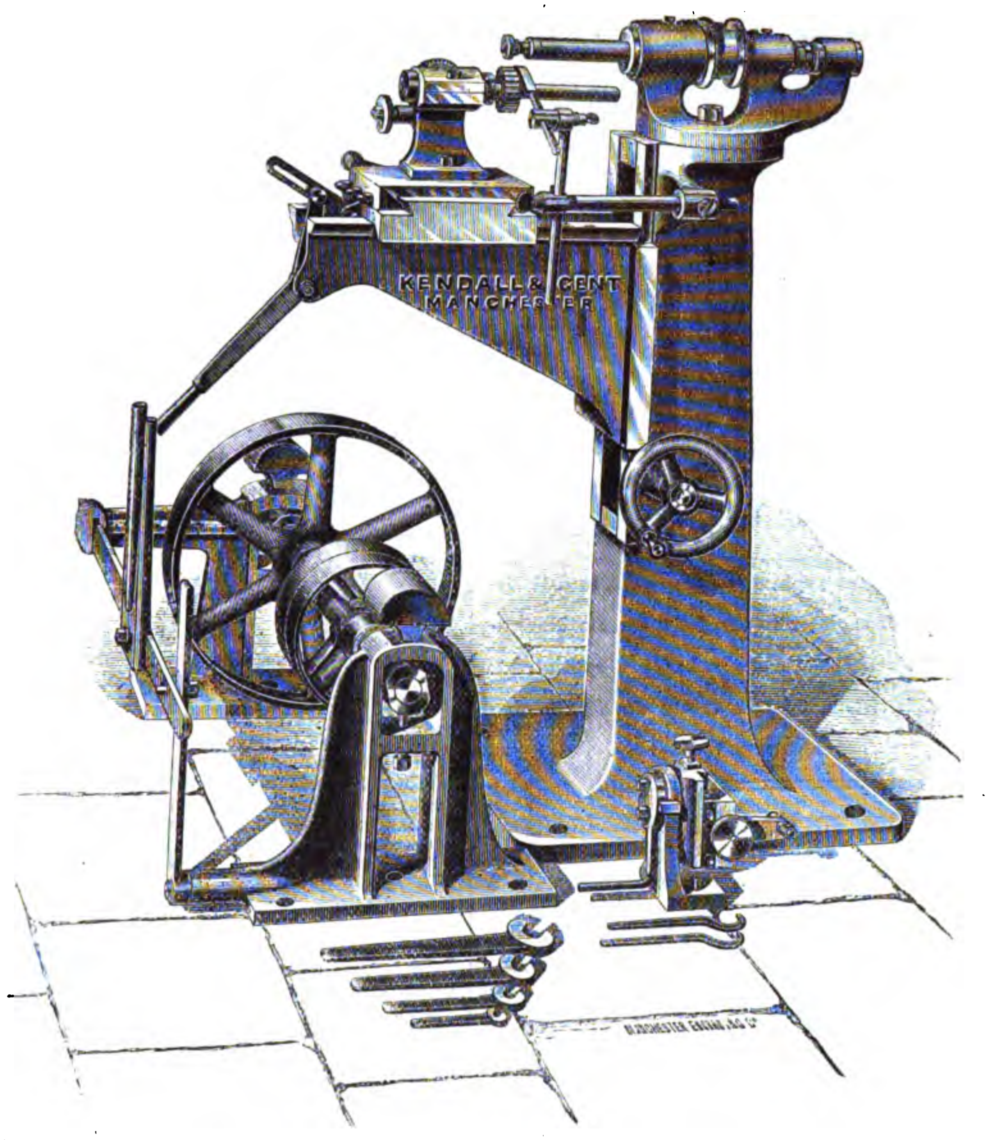


Fig. 4.

IMPROVED CUTTER GRINDING MACHINE.—For Description see Page 352.

Messrs. Wm. Simons & Co., of Renfrew, have received an order to construct, for an East Coast firm, a first-class steel screw steamer of 1,000 tons. It is to be built under Lloyd's special survey to class 100 A1, and will be supplied with triple-expansion engines, also constructed by the builders.

Messrs. Fleming & Ferguson, Paisley, last month booked an order for a steel screw steamer of 1,000 tons, for the Eastern trade. She is to be fitted with quadruple-expansion engines by the builders.

Messrs. Alexander Shanks & Son, Engineers, of Dens Iron Works, Arbroath, have changed their London office address from 27, Leadenhall Street to 110, Cannon Street, E.C. Their warehouse and show-room will be at 44, Tenter Street East, Goodman's Fields, E.

New Shipyard for West Hartlepool.—Messrs. W. Gray and Co. are commencing with the new shipyard they intend to construct on a site adjoining the West Hartlepool Marine Engine Works. When it is complete they will be able not only to build merchant and passenger steamers of the largest class now in use, but also to tender for the construction of naval ironclads for the British and other Governments, and the establishment will then rank among the largest in the kingdom.

The Phosphor Bronze Co., Limited.—It may interest your readers to know that the price of our "Vulcan Anti-friction Alloy" remains unaltered, notwithstanding the great advance in price of tin, which enhances in proportion the cost of *genuine* Babbitts' metals (not the spurious metal often *sold* as Babbitts'). Our Vulcan Anti-friction Alloy is about one-third the present price of Babbitts' *genuine* mixture, and practically answers the same purposes. *Vulcan* is our registered trade mark for certain of our specialities.

Delta Metal.—In consequence of the further advance in the price of copper, the prices of delta metal have been raised a further halfpenny per pound.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from November 24th to December 22nd, 1887.

Booth, John W., assistant engineer to the *Thames*, to date December 5.
Burner, Wm. Henry, has been appointed to the rank of staff engineer in Her Majesty's fleet.
Collingwood, Richard, assistant engineer to the *Racoon*, to date December 1.
Coopper, Herbert, assistant engineer to the *Thames*, to date December 5.
Darley, A. C., acting assistant engineer to the *Inflexible*, to date December 5.
Davis, Wm. Henry, chief engineer, has been appointed to the rank of staff engineer in Her Majesty's fleet.
Green, Richard W., assistant engineer to the *Trafalgar*.
Hay, Chas. J., assistant engineer to the *Impérieuse*, to date December 7.
Hobbs, Philip, assistant engineer to the *Revenge*, to date December 22.
Matthews, Edward, has been appointed to the rank of staff engineer in Her Majesty's fleet.
Monkhouse, Warwick, assistant engineer to the *Hero*, to date December 5.
Pearce, Wm. W., assistant engineer to the *Thames*, to date December 5.
Rees, John D., assistant engineer to the *Victoria*.
Stone, A. T. H., assistant engineer to the *Brisk*, to date December 15.
Swinney, George, staff engineer to the *Nile*, to date November 24.
Tregenna, Richard Henry, chief engineer, has been appointed to the rank of staff engineer to the *Euphrates*.
Webb, Arthur T., assistant engineer to the *Stirling*, to date December 22.
West, Frances F., assistant engineer to the *Starling*.

SOUTH WALES TRADE NOTES.

Cardiff.—During the past three weeks there has been quite a revival in the staple industries of the district, and in regard to the shipments of steam and house coal, the quantities exported have been many thousands of tons beyond the normal average of the year, and even those who take a pessimistic view of the trade of the port, are now compelled to admit that a genuine improvement has apparently set in. It is believed that in almost every department of trade this revival will continue for at least three or four months, whilst many believe that the new year will be a very prosperous one. Steam coal has been in exceptionally good demand, and prices are now very firm at 9s. 3d. to 9s. 6d. for coal with a special reputation, such as Nixon's Navigation. Good dry coals have been selling during the early part of the month, at 8s. 3d., but 8s. 6d. is now demanded, and in many cases obtained, whilst Monmouth and other inferior sorts have found a ready sale at 7s. 9d. to 8s. During the last fortnight there has been an upward move in small steam fuels, and within the past four or five days this commodity has advanced 3d. and in some cases as much as 6d. per ton, the latest quotation being 3s. 6d. to 4s. for ordinary small coal. This advance may be attributed to the improved demand from Italian and French ports, and from the better tone which now prevails in the home patent fuel manufactories. Welsh cokes have been in good request throughout the month, and since my last report fully an advance of quite 9d. per ton has been obtained for both foundry and furnaces. Patent Fuel.—During the past fortnight the patent fuel trade has exhibited signs of improvement. Orders are now coming into the market with something like regularity with the result that the heavy stocks in hand at the commencement of the month are diminishing rapidly. Should the present demand be maintained, prices which are now firm will, in the near future, be considerably improved upon. Pitwood.—At the early part of the month, pitwood was selling at 14s. 6d., and the demand was poor even at that unremunerative price. The improvement, however, in the steam and house coal trade, has had the effect of increasing the demand for this commodity, and this fact coupled with the bad weather which has prevailed during the past eight or ten days, which has prevented the arrivals of fresh imports, has had the effect of increasing the values very materially. During the past few days prices have steadily advanced and good wood was at the close of the last week difficult to obtain at 16s. Manufactured Iron and Steel.—A better tone now prevails; all the local works are well employed, and, as orders are now being placed for considerable quantities, the prospects of a steady trade being done during the winter months is almost assured. Quotations have undergone no material change. Bessemer Blooms are selling at £4 5s. and bars £4 15s., while Swansea pig is quoted 48s. at furnaces. Merchant Bars are realising £4 10s. to £4 12s. 6d., while steel rails, heavy section, the quoted prices are £4 5s. to £4 7s. 6d. Light section, £5 5s. to £5 12s. 6d. The Homeward ore trade from Spanish ports is a trifle easier, but from Carthagena there has been for some weeks an exceedingly good demand for boats discharging at East and West Coast ports of the United Kingdom, whilst the increase of tonnage at Bilbao for the Welsh ports has been exceptionally good. Rates for the Mediterranean ports are unchanged. In the freight market the increase of outward steam tonnage has been very active, and the number of fixtures reported for all directions has been considerably above the average. Rates for the Higher Mediterranean, Spanish, Gibraltar and Bay ports, continue firm. West Indian rates are steady, but there has been no change in the American outward rates.—The removal of Dowlais Works to Cardiff. Signing the agreement in London. Half-a-million of money to be spent forthwith. Nature and extent of new enterprise. We are now enabled definitely to give an account of the official steps taken in connection with the proposed removal of the Dowlais Works to Cardiff, and to specify in addition to the closing arrangements, other new and most important features which have, up to the present, been witheld from the public. We have the best authority for stating that the agreement between the Dowlais Iron Company and the Marquis of Bute, was duly signed and sealed during the week ending the 17th inst. in London. This agreement is for the lease of the land necessary for the erection of steelworks and all the appliances thereto belonging, and for building cottages for the workmen on the East Moors. The agreement was signed by the originator of the scheme, Sir Wm. Thomas Lewis, on behalf of the Marquis of Bute, by Mr. G. T. Clark and Mr. E. P. Martin, for Lord Wimborne, and by Mr. Pitman for the Bute Docks Company, of which he is chairman. Possession of the land is to be given at once, so that the Dowlais Company may proceed with the initiatory steps with the least possible delay. The scheme, as now finally elaborated, embraces the construction forthwith, to be completed within two years, of three blast furnaces of the largest size, and on the most improved principles, with all the accessories needed for the production of pig iron. Within three years afterwards, the works are to be extended, so as to include Siemens' furnaces, and all arrangements for the manufacture of steel sleepers, steel strip, boiler plates, and similar productions. Following this, the further extensions and complete removal of all operations at Dowlais are to be proceeded with, the complete removal to be effected within ten years from the date of agreement, and the Dowlais Works finally established on the largest scale in Cardiff. The works will eventually be built on the model of the largest of those in the United States, with the further additions, arrangements, and scientific appliances which have been brought to light and perfected there and here in recent years. This is not the whole of the information we are enabled to convey. It is well known to those conversant with the resources of Dowlais that comparatively little coal is now obtained in the parish of Merthyr, and that the No. 1 pit at Bedlinog has not proved at all well. No. 2 is the only one now worked. There is a well founded rumour that, driven to seek coal in other directions, Mr. H. Martin has been in the neighbourhood of Aberdare Junction lately with a view to arrange for the taking of a large tract of minerals, and removing the new colliery operations of the Dowlais Company to that neighbourhood from where they were intended to be, viz., the Rhymney-Bargoed Valley. It is thought that the amalgamation of the Taff Vale Railway and Bute Dock interests may have something to do with the change in the Dowlais Company's plan for sinking on the side of the Taff Vale instead of upon the side of the Rhymney Railway. It is known to mining engineers that a fine virgin vein of the best coal exists at Aberdare Junction, bounded on each side by proved takings such as the Penrhiwceiber, Merthyr Vale, Harri Navigation, Ynysybwl, and (latest success) the Albion. Taking Nelson Village as the centre of the eastern basin of Glamorgan, a sinking on the flat by Aberdare Junction may be expected to present less difficulties than were encountered at the Deep Navigation, and Dowlais would thereby be put in possession of a grand coal field

admirably placed for railway purposes, and with it Nos. 3 and 4 seams as convenient for its Dowlais Works as Mr. Crawshay's Colliery at Pontypridd is for Cyfarthfa. The news now announced may be implicitly relied on. Its importance may be estimated when we state that independently of the colliery operations, which will be of great magnitude, the removal of Dowlais Works to Cardiff is expected to entail an expenditure of half-a-million sterling on the part of the Dowlais Company alone. It is, however, held as certain that the course resolved upon by Lord Wimborne will be speedily followed by other owners of important industrial concerns. With regard to the new sinking operations of the Dowlais Company which they at one time intended to carry out at Deri, the site at Aberdare Junction was carefully examined by one of the most competent mining engineers just prior to the sinking of the Albion, with a view to the formation of a London Syndicate. His report covered an area of great extent requiring fully a hundred thousand pounds sterling to develope. The recommendations were submitted to a leading financial authority in London, but the coal trade at that time was very much depressed, and the scheme fell through.

Newport.—The tone of the market has almost without exception, during the past month, been characterised by more than ordinary buoyancy and hopefulness, caused by the solid conviction that the new year will bring in with it not only a larger volume of trade, but also more remunerative prices. There has almost been a continuous advance in tin, copper, spelter, and other raw materials. The latest quotations are: Straits tin, £166; Chili copper bars, £75 17s. 6d.; Scotch pigs, 43s. 1d.; and hematites, 44s. 10d. Steel.—Bessemer steel blooms, £4 5s.; and bars, £4 15s.; Siemens' bars, £5 2s. 6d. per ton, f.o.b.; Welsh ports less, the usual percentage for cash. Rails: Heavy sections, £4 to £4 5s.; light sections, £4 17s. 6d. to £5 2s. 6d. f.o.b. at works; sleepers, angles, charcoals, &c., according to specification; sheets, £7 10s. to £8 10s.; singles, with the usual extras for other gauges. Tin Plates.—Iron coke tins (B. V. grade), 15s. 3d. to 15s. 6d. per box i.c.; Bessemer steel, cokes 15s. 9d. to 16s.; Siemens, with coke finish, 16s. to 16s. 3d.; charcoal tins, 15s. to 22s., according to finish, as grade; ternes (28 by 20), 26s. to 28s. per double box, i.c., f.o.b., Welsh ports, less the usual percentage for cash; wasters, 6d. to 9d. less than prices. Iron.—Welsh merchant bars, £4 10s. to £4 12s. 6d., f. o. t., at works, with angles, &c., at the usual extras; sheets, singles, £6 17s. 6d. at works. Pig Iron.—Middlesboro', No. 3, 34s. 3d. to 34s. 6d.; Swansea hematite Bessemer pig iron, 48s.; Cwmavon best, 48s. f.o.t. at works, with the usual discount for cash. Pitwood.—15s. 3d. to 15s. 6d. Iron Ore.—11s. 9d. to 11s. 10½d. Steam Coal.—Best qualities, 7s. 9d. to 8s.; seconds, 7s. 3d. to 7s. 6d.; screenings, 4s. 3d. to 4s. 6d.; house coal, 9s. 3d. to 9s. 9d., according to quantity; smith's coal, 5s. 3d. to 5s. 9d.; freights still remain firm all round.

Swansea.—The exports from this port during the past month favourably compare with the period immediately preceding it, and in most of the staples of the district the demand has been sufficiently large as to indicate a general revival in the near future. In the tin-plate trade, and other metallurgical industries, there has been considerable vitality, and this fact is certainly assuring when the unusal circumstances which now envelops the metal trades is considered. The Tin Syndicate is still actively operating, and it is reported that they had succeeded in disposing of 1,000 tons of block tin at the top price touched, viz., £165 to £166 per ton. Tin plates continue to advance in price, but not nearly to an extent commensurate with the price of the raw material, and, therefore, should the report referred to be true, tin-plate in the new year will probably be quoted at a high figure. In the manufactured iron and steel trades there is now increased vitality. All the local works are in full swing, and large sales of steel have been made, while finished have been advanced at least 2s. 6d. a ton. Pig iron has also risen considerably in price, and is still advancing.

Chepstow. — New Passenger Steamer for the Bristol Channel.—We understand that Sir Wm. Thos. Lewis of Cardiff, has placed an order with Messrs. Edward Finch & Co., Limited, marine engineers and shipbuilders of this port, for a superior saloon paddle-steamer, for the conveyance of passengers and merchandise between the ports of Cardiff and Bristol. The vessel, which will measure some 260 tons gross, is to be wholly built of Siemens' process steel, to be manufactured by the Dowlais Iron Company, Dowlais. Her boilers will also be made of the same material. The vessel is to have a spacious under-deck saloon forward, with ladies' private cabin, a large passenger shelter-house amidships, and a first-class saloon aft, with ladies' private cabin, superior refreshment bars being fitted to each saloon. A private dining-saloon will also be fitted up below aft. There will be a fine promenade deck extending over the after saloon, and the amidships shelter-house. The vessel will be elegantly fitted out, and provided with every convenience for the accommodation and comfort of all classes of passengers. The machinery will consist of a pair of vertical compound surface condensing oscillating paddle engines of 125 H.P. nominal, with paddle-wheels about 16 ft. diameter. The boilers, two in number, are to be of Navy type, about 8 ft. 9 in. diameter, and 17 ft. long, and will be placed wholly under deck. They will supply ample steam for upwards of 750 H.P. indicated, which will enable the vessel to make her passage in all weathers at a speed of not less than 14 knots per hour. She will thus be superior to anything of her class that has yet appeared in the Channel. We also understand that this firm have secured the order for the large caissons for the new "Barry Graving Dock."

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE improvement in Clyde shipbuilding, engineering, and cognate industries, which set in two months ago, has continued throughout December, or as much of it as is passed at the date of writing these notes (22nd). The enormous figure of 76,000 tons of new shipping have been ordered from Clyde builders, by far the largest proportion being for steamers. Notwithstanding the large amount of tonnage ordered, a number of shipbuilding contracts (the negotiations in connection with which had proceeded a considerable way) have been withdrawn from the market because builders declined to accept additional work, except at 10 to 15 per cent. advance in prices. This increase has been rendered imperative by the rise in the cost of material. The great proportion of the vessels recently fixed have been at very low rates. The engines for one or two of the steamers are being made away from the Clyde, but to compensate for this several sets of engines are being made in the district for hulls building elsewhere. The largest contractors for new work are Messrs. Russell & Co., of Port Glasgow and Greenock, who, during the month, have booked as much as 8,000 tons, and between their three yards have at the present time altogether about 18 vessels, on hand or to lay down, aggregating about 45,000 tons. The most important contracts fixed during the month were two steamers of over 5,000 tons each, to be built by Messrs. Caird & Co. for the Peninsular and Oriental Steamship Company. The vessels are to be fitted up with all the latest improvements, and will be supplied by the builders with engines on the triple-expansion principle. Another order of importance was that for two steamers of over 3,000 tons each, placed with Messrs. D. & W. Henderson & Co. by Messrs. Bell Brothers and McLelland. These steamers will be fitted up with all modern improvements, similar to the three other steamers built for the firm earlier in the year. Other two steamers of considerable tonnage were those ordered by Messrs. Burrell & Son, Glasgow, for their general trade, one of over 3,500 tons from Messrs. A. Stephen & Son, Linthouse, and one of about the same tonnage from Messrs. Russell & Co.

The Fairfield Shipbuilding and Engineering Company have recently concluded negotiations with the London, Brighton and South Coast Railway Company for the construction of a paddle steamer for the Channel trade, of nearly 1,200 tons, to be fitted with compound engines of great power to give her a high rate of speed. The vessel will be similar to the one now building at the Fairfield Works for the same company.

Messrs. A. Stephen & Sons, Linthouse, in addiiton to the large steamer already alluded to, which they are to build for Messrs. Burrell & Son, have received an order from Mr. J. B. Murray, of the "State" Line, for a steel steamer of 2,800 tons, to be engaged in general service. The cargo capacity will be about 4,000 tons. They have also recently contracted to build a first-class steel screw steamer of 3,000 tons for Messrs. Thomas Dunlop & Sons, Glasgow.

Messrs. Aitken & Mansel, Whiteinch, have contracted to build a steel screw steamer of 3,000 tons for the Eastern trade. The engines will be supplied by Messrs. John & James Thomson, Finnieston, Glasgow, and will be of the triple-expansion type to indicate 3,000 H.P. They have also secured an order to build a steel screw steamer of about 1,000 tons for the Ceylon coasting

trade, the engines of which are to be made and furnished by Messrs. Hutson & Corbett, Kelvinhaugh Engineering Works, designed to drive the vessel at an average speed of 10 knots at sea, loaded.

Messrs. Charles Connell & Co., Scotstoun, have secured a contract to build a large steamer for Messrs. James Gardiner & Co., Glasgow. The new steamer will be similar to the *Oronsay*, constructed by the same firm, and launched last June. The tonnage of the vessel will be about 2,200 tons. The engines are to be supplied by Messrs. D. Stewart & Co., Glasgow.

Messrs. W. Simons & Co., Renfrew, received at the beginning of the month an order to construct for an East Coast firm a first-class steel screw steamer of 1,000 tons. The vessel will be supplied with triple-expansion engines by the builders. Messrs. Simons have also contracted to build and engine two steam launches for foreign owners. The launches are to be about 60 ft. in length, and are to be fitted for carrying passengers.

Messrs. John Fullerton & Co., Paisley, secured orders at the end of last month for two steamers, one of 560 tons, for Glasgow owners, and the other of 250 tons, for a Liverpool firm. Messrs. Fullerton have also contracted with Mr. W. Robertson, Glasgow, to build a steamer of 400 tons for the coasting trade.

Messrs. Fleming & Ferguson, Paisley, about the middle of the month, received an order to construct a steel screw steamer of 1,000 tons for the Eastern trade, which they will fit with quadruple-expansion engines.

In addition to one or two important orders which have been received by W. Denny & Bros., another Dumbarton firm—Messrs. McMillan & Son—have secured a contract for a sailing vessel of 1,600 tons for a Canadian firm.

Messrs. Birrel, Stenhouse & Co., of the same town, have received an order to build a large steel four masted sailing ship of large carrying power for Glasgow owners.

Messrs. John Reid & Co., Port Glasgow, received an order early in the month for the construction of a steel screw steamer, of about 3,000 tons deadweight, from Messrs. Aitken & Walker, Glasgow, for that firm's Mediterranean and Black Sea trade. The same firm of builders have also secured a contract for a steel sailing ship of 1,600 tons for a Liverpool firm.

Messrs. Murdoch and Murray, of the same town, have secured a contract for a steel screw steamer of over 3,000 tons carrying capacity from a Glasgow firm. It may be stated, as an example of the revival in trade, that it is now about three years since this firm had a contract of any size on hand.

Messrs. Robert Duncan & Co., Port Glasgow, have been instructed to build a steel screw steamer, of about 3,000 tons deadweight carrying capacity, for Messrs. Aitken & Walker, Glasgow. The engines, which will be of the triple-expansion type, are to be supplied by Messrs. Muir & Houston, Kinning Park. The same firm of builders have also secured a contract for a steel barge of 1,300 tons for a London firm, and about the middle of the month they were commissioned by Messrs. James Little & Co., Buchanan Street, Glasgow, to build for them a steel screw steamer of 2,800 tons deadweight carrying capacity for the general trade. These orders, in conjunction with those already noted as having been secured by Messrs. Russell & Co., are welcomed in the Port Glasgow district as providing employment for hundreds of workmen up till now out of work.

Messrs. Scott & Co., Greenock, have during the month contracted to build and engine two steel screw steamers, one of 1,650 tons, for the African coasting trade, and the other of 2,500 tons, for the Ocean Steamship Company of Greenock.

Messrs. Rankin & Blackmore, engineers of the same town, have concluded a contract with Messrs. Russell and Co., shipbuilders, for a set of their patent disconnective quadruple expansion engines for a cargo steamer of 4,000 tons deadweight, building by Messrs. Russell. Steam at a working pressure of 180 lbs. is to be supplied, by means of two steel boilers of unusually large size, to work in conjunction with mild forced draught, in connection with which, and other special improvements, there has been guaranteed an abnormally low consumption of fuel. In view of the brighter prospects in the shipbuilding trade, the shipbuilding yard formerly occupied by Messrs. R. Steele & Co. in the East End, which has been shut up for several years, will shortly be exposed for sale. Rumours of other shipbuilding orders have been in circulation for the past few days.

For two steamers building by Messrs. Workman & Clarke, Belfast, for Glasgow owners, Messrs. Clark & Service, and Mr. Cuthbertson respectively, engines are being constructed in two of the Glasgow shops.

The Ayr Shipbuilding Co. (G. McKnight & Co.) have secured a contract to build a powerful screw tug of 90 H.P. for Cardiff owners.

Messrs. McKnight are negotiating contracts for a steel steam yacht of 200 tons for Glasgow owners, and also a steamer of 1,900 tons deadweight for Leith owners.

The Campbeltown Shipbuilding Co. recently received an order to build a steamer of 1,700 tons register for Messrs. R. H. Dixon and Co., Glasgow.

The Grangemouth Dockyard Co., about the middle of the month, contracted to build a steel screw cargo steamer for a Glasgow firm. She is to have a carrying capacity of about 2,300 tons, and will be fitted with triple-expansion engines. They have recently secured a contract for a steamer of 1,400 tons.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Since last month a very marked change for the better has taken place in the condition of the local shipbuilding trade, and from the number of orders booked by the various firms engaged in the industry, there can be no doubt that this year will be a busy one. Nearly the whole of the vessels ordered are to be built of steel, and one great difficulty which now lies before shipbuilders is the insufficiency of productive sources for this material. Though the work on hand is as yet limited, compared to what it is likely to be in the early months of the year, operations are impeded at several yards through the absence of material, which, if the capabilities of production were anything like equal to the demand, ought to have been long since delivered. There is, fortunately, a prospect that the evil will be minimised by the opening out of new works after the holidays; but there is good reason to believe that the prospective increase of productive power will fail to meet the increased requirements of shipbuilders. When this is made abundantly clear by actual experience, new ventures in the way of steel making will possibly be undertaken, but there seems at present to be plenty of scope for the judicious expenditure of capital in this direction, and when a real want is found to exist, those who are first in the field to meet it generally fare the best. In last month's report it was stated that Messrs. Armstrong, Mitchell & Co. were doing very little at their Elswick and Low Walker yards. Little change has since occurred at either establishment, but with reference to the first, it may be stated that there are on the stocks two small "test ships" ordered by the Admiralty, which are to be taken to pieces and conveyed to Chatham dockyard for reconstruction. There is also on the stocks a small cruiser ordered by the Roumanian Government, which is to be launched in the course of a few days, and a much larger vessel of the same class, which is understood to have been laid down on the speculative principle, and is at present not being proceeded with. The latter vessel is to be supplied with quadruple-expansion engines, and is expected to attain a rate of speed hitherto unapproached by cruisers. At the Low Walker yard, belonging to this firm, some merchant vessels of the very largest class are about to be laid down, and most of the berths will be filled up before the first quarter of the coming year is ended. Messrs. Hawthorne & Leslie have recently booked important orders, and have just launched a very handsome vessel of a special class for Brazil. Messrs. Wood & Skinner launched on the 15th ult. the second of two steamers intended for trading on the Black Sea, and are now preparing to lay down a vessel nearly 300 ft. long. Messrs. Dobson & Messrs. Richardson are each framing a vessel, and Messrs. Swan & Hunter have just laid the keel for one of exceptionally large size. The Tyne Shipbuilding Company launched a vessel named the *Kalnac* during the past month, and have resumed frame turning after a somewhat prolonged stoppage in this department. Messrs. Palmer are credited with the possession of a great amount of work, and appearances indicate the near approach of an exceptionally busy time so far as their establishments are concerned. The firm launched about the middle of last month a sister ship to the *Locksley Hall*, launched a month previously. Messrs. Readhead have been amongst the largest recipients of orders lately, and independently of any further contracts which may be taken the firm have now sufficient work arranged for, to keep their yard busy up to the end of August next. In the marine engineering establishments orders have rapidly accumulated during the past month, and every concern on the river, which is exclusively devoted to this branch, is now quite

full of work. One or two firms, which combine other branches of engineering with marine work, have also received orders for engines of the latter class, and will probably be disposed to enter more largely into this department of the business than they have hitherto done. The North-Eastern Railway Company, who have turned out some fourteen compound locomotive engines, and about a score of engines of the ordinary type from their shops at Gateshead during the year, have now in progress half-a-dozen engines of the former kind, and are also largely engaged in repair work. The state of business in Messrs. John Abbot & Co.'s works has greatly improved, particularly in the foundry, brass finishing shops and rolling mills. Messrs. Black & Hawthorn's establishment is still quite busy in nearly all departments, a state of affairs which, it may be stated, has now existed for some months. Mr. Wasteneys Smith, Newcastle-on-Tyne, has just received orders for upwards of 25 outfits of his patent "stockless," for large steamers recently fixed with the builders. In all these vessels the new method of stowing these anchors up the ordinary hawse pipes is being adopted, which dispenses with all catting and fishing gear. Upwards of 60 steamers have already been fitted in this manner.

The Wear.—The close of the year shows a much better state of trade in Sunderland than was to be discerned at the beginning. One or two of the leading shipbuilding firms were then pretty well off for orders, but all have now a share, and the leading firms referred to have as many engagements in the way of contracts for new vessels as they can conveniently deal with for many months to come. Since the beginning of the past month Messrs. J. L. Thompson & Sons have framed two large vessels, and the framing of others is now being proceeded with. The use of Tweddell's hydraulic riveters greatly facilitates the framing work at this establishment, and it is not too much to say that without those effective aids the work could not be executed with the rapidity now attainable. Messrs. Short Brothers have orders from local owners for several vessels of a large class, and they are receiving material for vessels that are not likely to be laid down for some months yet. Mr. Laing has also a number of good orders, but as yet the state of business in the yard does not show much improvement. Messrs. R. Thompson & Sons have orders for two large steamers, and Messrs. Pickersgill have secured the contracts for a steamer and a sailing ship. Messrs. Doxford have two steamers to put down, and the Sunderland Shipbuilding Company have just laid the keels for three. Messrs. Bartram & Haswell, Messrs. Blumer, Messrs. Austin, and the Strand Shipbuilding Company have each a limited amount of work in hand, with a fair prospect of beginning the year with more vessels on the stocks. The Palmer's Hill Engine Works are exceedingly busy, and both there and at the Southwick Engine Works night shifts have been put on. The North-Eastern Engineering Works, South Dock, are becoming busier daily, and in the foundry and pattern shop large additions have been made to the number of hands employed. Messrs. Doxford have two sets of engines to build, and it is to be presumed that the company, into whose hands the works formerly known as "Messrs. Carr & Co.'s" have passed, are not unprovided with contracts, as they are preparing for starting the establishment. On the whole, it may be stated, without much fear of exaggeration, that there are between 50 and 60 sets of engines now contracted for at the different engineering works on the Wear. In connection with engineering it may be stated that Mr. Madison, a local inventor, has arranged for the fixing of his newly patented "Electric Marine Governor" on board the s.s. *Falcon*, now undergoing repair by Messrs. J. L. Thompson & Sons. As this is the first vessel in which the new "Governor" has been placed, the results of the trial will be watched with interest. It has been rumoured that Messrs. S. Tyzack & Co., of the Monkwearmouth Ironworks, contemplate entering into the steel manufacture at an early date. The firm commenced the manufacture of "taper packing" for shipbuilders' use some time ago, and they are now pretty well engaged in the production of Messrs. Bell & Rockliff's patent rolled sections for ships' bulwark rails, hatchways, &c., of which they are the sole manufacturers.

The Tees.—Shipbuilders at Stockton and Middlesbro' have participated to a satisfactory extent in the better business which has lately been developed, and with most of them the new year will be commenced under favourable conditions. Engineering firms are also getting their full share of orders, and for at least the first half of 1888 there will be little danger of slackness, at all events, in such establishments as are mainly or exclusively devoted to marine work. The pressure of business at the steel works is very great, and cannot fail to continue so for many months.

The Hartlepools.—The shipbuilders at this centre have been amongst the most successful in securing orders lately, one leading firm having on a recent occasion contracted for no less than four large steamers in one day. At all the yards the outlook for 1888 is exceptionally good, and the same may be said with reference to the marine engine works. Both the Central Marine Engineering Company and Messrs. T. Richardson & Sons have recently booked important orders, and the full resources of the establishments are certain to be utilised for a long time.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Byculla.—On November 29th there was launched from the shipbuilding yard of Messrs. Wm. Bayley & Sons, Ipswich, Suffolk, a ketch-rigged barge of the following dimensions:—Length, 85 ft. 5 in.; breadth, 20 ft. 8 in.; depth, 7 ft.; 85·71-100 gross, 77·31-100 tons register. Specially surveyed while building to Class A1 10 years at Lloyd's. She is the property of Mr. Edward Garnham, of Chelmondiston, Suffolk. As she left the ways she was christened *Byculla* by Miss A. Garnham.

Industry.—On November 30th there was launched from the shipbuilding yard of the Strand Slipway Company on the Wear, an iron steamer of the following dimensions:—Length, 260 ft.; breadth, 35 ft. 6 in.; depth, 18 ft. 9 in. She has long bridge to forward of foremast, raised quarterdeck, full poop, and will carry 2,450 tons deadweight. The triple-expansion engines, of 150 H.P., are to be fitted by the North-Eastern Marine Engineering Company (Limited), Sunderland. The large boilers will be fitted with Henderson's patent self-cleaning furnaces. The vessel has an extra large donkey boiler; it is fitted with four steam winches, Messrs. Harfield's patent windlass, and Pepper's patent steering gear (manufactured by Messrs. Roger & Co., of Stockton-on-Tees). As the vessel left the ways she was christened the *Industry* by Mrs. Cockerline, wife of the managing partner of the firm of Messrs. W. H. Cockerline & Co., of Hull, for whom the vessel has been built. The superintending engineer and surveyor is Mr. Jamieson, of the firm of Messrs. Jamieson & Taylor, Hull.

Chindwin.—On December 3rd there was launched from the shipbuilding yard of Messrs. Cook, Welton & Gemmell, at Hull, a steam trawler named the *Chindwin*, built by that firm to the order of Mr. G. Beeching, fish merchant, of Hull. The *Chindwin* is a sister ship to the *Irrawaddy*, which was built two years since for the same owner, but has several improvements, which experience has suggested both to the builders and the owner. The dimensions of the *Chindwin* are:—100 ft. by 20 ft. by 10 ft. 6 in. Her engines will be fitted by Messrs. C. D. Holmes & Co., and will be 45 H.P.N. The *Chindwin* is the tenth steam trawler which Messrs. Cook, Welton & Gemmell have built during the past two years.

Junio.—On Wednesday afternoon, December 14th, there was successfully launched from the yard of Messrs. William Doxford and Sons, Pallion, the fine new screw steamer *Junio*, built for the Compania Bilbaina de Navegacion, Bilbao; Directors, Messrs. Agnad & Astignoaga. On leaving the stocks she was gracefully christened by Miss Dickinson, daughter of William Dickinson, Esq., of Benton, Newcastle. In performing the ceremony, success and prosperity was desired in the words "Buena Suerte y Muchos Cuartos al *Junio* y la Compania Bilbaina de Navegacion." The *Junio* is built of steel, 275 ft. by 39 ft. 6 in. by 24 ft. 9 in., on the spar deck rules with two decks laid and beams for third deck being prepared for wine trade. Her engines are triple-expansion, 21 in., 35 in. and 57 in. by 39 in. stroke. The vessel will carry 3,300 tons cargo on 20 ft. draft, and is in every way fitted with the most modern arrangements for economical trading. She has been built under the superintendence of Mr. Antonia Uribe, superintendent of the Company, and the engines have been supervised by Mr. William Baird. She will sail under the command of Captain Aspiazu. The launch was witnessed by a large assembly of friends, among whom were Mr. W. Dickinson, Newcastle, Mr. L. Astigaraga, Commodore Zaragosa, Captain Torrens, Captain Rasche, of the *Marquis de Mudela*.

Karnak.—On December 14th there was launched from the yard of the Tyne Iron Ship Building Co., Ltd., of Willington Quay-on-Tyne, a screw steel steamer of the following dimensions:—length, 290 ft.; breadth, 40 ft.; depth moulded, 27 ft. Gross tonnage about 2,520 tons. She is built to Class 100 A1 at Lloyd's,

and will be fitted with triple-expansion engines by Messrs. Wigham, Richardson & Co.; cylinders 24 in., 37 in., and 62 in. by 42 in. stroke, 150 lbs. pressure, and has all the latest improvements for working the ship and cargo. The vessel is for the Deutsche Dampfschifffahrts Gesellschaft Kosmos, of Hamburg, and on leaving the ways was gracefully named the *Karnak* by Mrs. Saggau, of Hamburg.

Somerhill.—On December 14th Messrs Richardson, Duck and Co. launched from their shipbuilding yard a steel screw steamer of the following dimensions:—Length over all, 292 ft.; breadth, 37 ft.; depth in hold, 20 ft. 6 in.; gross tonnage, about 2,260 tons. This vessel has a raised quarterdeck and long bridge extending to fore hatch and has been built to the order of a London firm. She will be classed 100 A1 at Lloyd's under special survey. The captain, officers, and engineers are accommodated in a poop aft and the crew are berthed in the topgallant forecastle. The vessel has a double bottom throughout on the cellular principle, and is fitted with all latest improvements including patent stockless anchors, &c. The engines are by Messrs. Blair & Co., of the tri-compound type, with cylinders 21½ in., 35½ in., 58½ in., and 39 in. stroke. As the vessel was leaving the ways she was gracefully christened the *Somerhill* by Miss A. L. Richardson, of Potts Hall.

Melbourne.—On December 15th Messrs. Edward Withy and Co. launched from their shipbuilding works at Hartlepool, before a large concourse of people, a screw steamer built to the order of the well-known Australian firm, Messrs. W. Howard Smith and Sons, Limited, of Melbourne, Sydney and Brisbane. The vessel is a fine type of a modern cargo boat, and is built of Siemens-Martin steel, and from the fine design of her lines it is anticipated that a good speed will be attained by the vessel. She is a steamer over 300 ft. in length with a large measurement and deadweight carrying capacity, and built to the 100 A1 class under special survey at Lloyd's. The vessel has a long raised quarterdeck, short poop and long bridge house with a topgallant forecastle. For extra strength and in order that the vessel may be economically kept up, all decks, deck erections, skylights, bulwarks, rails, bulkheads, &c., are built of iron or steel. In the main and after holds she is built on the web frame system, which gives a very strong type of ship and dispenses with all hold beams, thus enabling the vessel to carry cargoes of the most bulky description, such as machinery, torpedo boats, large guns, &c. She has a cellular bottom all fore and aft (Withy & Sivewright's patent) and the after peak will also be available for water ballast. Nearly all the steel plates are in 24 ft. lengths, making the structure of the ship very strong. Four steam winches will be fitted —one to each hatch with a patent windlass on forecastle. There is a very great improvement in the anchor arrangements and fittings in connection with this vessel. Instead of the anchors having to be landed on to the forecastle deck with davits, &c., she is fitted with stockless anchors hauling up into hawse pipes, which, at a moment's notice, one man attending the windlass can hoist or lower away immediately, thus leaving the remainder of the crew for other duties. Two donkey boilers are fitted in the fore end of the boiler room, hand and steam steering gear amidships, and Hastie's patent screw stand-by gear aft. The accommodation for officers, passengers, &c., is under the poop aft and is fitted up in hardwood with beautifully hand-painted panels by the lady decorative staff of the firm. The vessel is rigged as a two-masted fore and aft schooner having iron masts with square sail on foremast. She will be fitted with triple-expansion engines by Messrs. T. Richardson & Sons, Hartlepool, with two boilers. This firm's engines are well known all over the world for their satisfactory working and for their great saving of coal over the old type of compound engines. The vessel has been built under the superintendence of Mr. J. C. Kinghorn, M.I.N.A., at Liverpool. On leaving the ways the vessel was gracefully christened *Melbourne* by Mrs. H. Withy, wife of one of the builders.

Nicholas.—On December 14th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., a steel screw steamer, built to the order of the Russian Company for Transport and Insurance. Her principal dimensions are:—Length, 220 ft.; breadth, 30 ft; depth, 20 ft. to awning deck. She has been built under Lloyd's special survey, and will be classed 100 A1. The engines are by the North Eastern Marine Engineering Company, Limited, Wallsend, built on the triple-expansion system, and of 650 I.H.P., to propel the vessel loaded 10½ knots. The vessel, which was named the *Nicholas*, has been specially designed for the coasting trade of the Black Sea, and is a sister ship to the *Platon*, launched a month ago by Messrs. Wood, Skinner and Co. As the vessel left the ways she was gracefully christened by Miss Alice Wood, and was immediately afterwards towed away to Wallsend to receive her machinery. Captain Safonoff has represented the company in England during the construction of these vessels, and Mr. Loupanoff has inspected the machinery.

Alagoas.—On December 15th, at the shipbuilding yard of Messrs. R. & W. Hawthorn, Leslie & Co. (Limited), a stern screw passenger steamer for the Brazilian Royal Mail service was launched. Her principal dimensions are:—276 ft. by 38 ft. by 21 ft. 6 in. Accommodation is provided for 100 first-class and 400 steerage passengers. She is in every way fitted up with all the latest improvements to adapt her specially for first-class passenger service. She is built to the highest class at Lloyd's, and has also the Board of Trade passenger certificate. On leaving the ways the vessel was named the *Alagoas* by Mrs. Robinson, of Rio Janeiro.

Branksome Hall.—On December 15th, at the shipbuilding yard of Palmer's Shipbuilding and Iron Company, a steel screw passenger steamer, intended for the India and general trades, was launched. She is a sister ship to the *Locksley Hall*, launched a month previous, and the *Rufford Hall*, now in course of construction, these three vessels being built for the Hall line, managed by Messrs. Robert Alexander & Co., of Liverpool. The description is as follows:—Length between perpendiculars, 380 ft.; breadth moulded, 45 ft.; depth, 30 ft. 3 in.; and depth of hold, 27 ft. 6 in. She will carry 6,000 tons deadweight, on a moderate draught. She has been built of special strength, beyond what is required by Lloyd's for the three deck class, and has cellular double bottom throughout. There is a long promenade deck amidships, with accommodation for 60 first-class passengers. There will be a long poop fitted for the accommodation of the second-class passengers at the fore end, and for the crew at the after end. The electric light will be fitted in saloon, state rooms, engineers' and officers' berths. The vessel will be propelled by a set of triple-expansion engines, also constructed by the Palmer's Company. They will have cylinders, 29 in., 47 in., and 76 in. diameter, with a stroke of 51 in. The vessel was christened the *Branksome Hall* by Mrs. Berkeley Molyneux, wife of Mr. Molyneux, of the Bank of England, Newcastle.

LAUNCHES.—Scotch.

Pago.—On November 21st Messrs. Wm. Denny & Brothers, Dumbarton, launched the steel built paddle-wheel steamer *Pago*, of 674 tons, for the Irrawaddy Flotilla Company, Limited. She will be fitted by Messrs. Denny & Co. with compound engines of 1,500 H.P. effective. The ceremony of naming was performed by Miss Mary Lawrenson, niece of George J. Sevann, Esq., C.I.E., the general manager of the company.

Caloric.—On December 1st Messrs. Alexander Stephen & Sons launched from their works at Linthouse a fine steel screw steamer of 100 A 1 class, and about 1,700 tons gross, built to the order of Mr. Ebenezer Kemp, Overbridge, Ibrox. The vessel was named the *Caloric* by Miss Stephina Kemp. The *Caloric* is a cargo steamer of the highest type, with large measurement capacity as well as deadweight carrying power, and is fitted with steam windlass, steam steering gear, steam winches, and all the best appliances for practical working. A specialty in the design is that the whole of the accommodation for captain, officers, and engineers is in houses on top of the main bridge, which latter is of unusual length, and encloses a large extra cargo space. The vessel is fitted with Messrs. Stephen's triple-expansion engines, having cylinders 18 in., 29 in., and 46 in. diameter, by 39 in. stroke, and Kemp's patent compound high and low temperature boilers, suitable for 160 lbs. working pressure.

Chamroen.—On December 1st there was launched from Messrs. Ramage & Furguson's shipbuilding yard at Leith, a steel twin-screw steamer of 500 tons deadweight capacity, built to the order of the Scottish Oriental Steamship Company, Limited, for their local trade in Siam. The vessel on leaving the ways was named the *Chamroen*, by Mrs. Jones, wife of the captain.

Kisunga.—On December 5th Messrs. John Reid & Co. launched from their shipbuilding yard at Port Glasgow a steel screw steamer of 2,000 tons nett register. The vessel is named *Kisunga*, and is built to the order of a Liverpool firm. She will be taken to Liverpool, where she will be engined by Messrs. D. Rollo and Sons.

Chester.—On December 5th Messrs. Russell & Co. launched from their Greenock yard a large steel screw steamer for the petroleum bulk carrying trade between America and the continent. This vessel is 310 ft. long, 39 ft. beam, and 25 ft. depth, and is capable of carrying about 3,500 tons of oil. The vessel is divided into 16 oil-tight compartments, exclusive of the water ballast tanks, and from the peculiar nature of the cargo to be carried, great care has been taken with the workmanship throughout, and the tanks have been subjected to exceptionally severe tests before launching, which they stood very satisfactorily. The vessel will be lighted throughout by electricity, and is fitted with a powerful set of Worthington pumps, capable of discharging the entire cargo in about 24 hours. Triple-expansion engines will be supplied by Messrs. Duncan, Stewart & Co., of Glasgow, the cylinders being 22 in., 36 in., and 58 in., with a stroke of 42 in. There are two large single-ended boilers, the working pressure being 160 lbs. This is the first vessel of the kind, we believe, that has yet been built on the Clyde, and with her sister ship now on the stocks, in the same yard, have been built to the order of Messrs. Hermann, Stursberg & Co., of New York, from the plans and specifications of Messrs. Flannery & Blakiston, consulting engineers, of Water Street, Liverpool, who have also superintended the vessel during construction. Mr. F. W. Randebrock, of New York, and Mr. Horstmann, of Rotterdam, represented the owners at the launch, and the christening ceremony was gracefully performed by Mrs. Randebrock, who named the vessel the *Chester*. The *Chester* will be commanded by Captain S. Wohlnuth, late of the North German Lloyds. The sister vessel will be launched in about a month. The managers in this country for both vessels are Messrs. R. W. Leyland & Co., Liverpool.

Screw Tug.—On December 14th there was launched from the yard of the Abercorn Shipbuilding Company, Paisley, a screw tug of 100 tons measurement. The dimensions are as follows:—Length, 100 ft. by 18 ft. 6 in. by 9 ft. 6 in. The engines, which will be supplied by Messrs. Hanna, Donald & Wilson, Paisley, are to be triple-expansion, of 350 I.H.P. The steamer is intended for towing ships over the bar at Rio Grande do Sul.

Garmoyle.—On December 19th there was launched from the shipyard of W. S. Cumming, Blackhill Dock, Glasgow, a steel screw hopper dredger named the *Garmoyle*, of the following dimensions:—70 ft. by 18 ft. by 6 ft., which has been built to the order of Messrs. P. Hampson & Co., Belfast, for their sand trade there, a trade which they have largely developed during the past few years, and which the present vessel is expected to greatly augment. She is fitted with a large cane dredger, which stands on the after deck, working all round the stern and sides, and when fully loaded will carry about 100 tons deadweight. In addition to the ordinary dredging gear, the vessel is self-propelling, the motion being taken from the crane engine working on to a Wrenchs' patent propeller. The dredging machine is the well-known patent of Messrs. J. Jessop & Sons, engineers, Leicester, which is now coming greatly into use among contractors and others, notably the Clyde Trust, where its performance has given great satisfaction. After getting machinery aboard, the *Garmoyle* will be fully tested on the Clyde preparatory to her sailing for Belfast. While being constructed here she has been under the personal superintendence of Mr. F. H. Blackwood, of the firm of Messrs. Blackwood & Lamb, agents in this country for Messrs. J. Jessop and Sons.

LAUNCHES.—Irish.

Maiden City.—On November 19th there was launched from the Foyle Shipbuilding yard, Londonderry, a steel barque of 1,200 tons register, and of the following dimensions:—Length, 230 ft.; breadth, 33 ft.; depth, 20 ft. She has been built to the order of Messrs. Thomson, Dickie & Co., Royal Exchange Square, Glasgow. As she left the ways she was named the *Maiden City* by Mrs. Robert Dickie, Glasgow. She was towed to the finishing berth, where she will be completely rigged and fitted out. She is intended for the East Indian Trade, and will be commanded by Captain Montgomery.

Arcadia.—On December 17th the s.s. *Arcadia* was launched from the shipbuilding yard of Messrs. Harland & Wolff, Belfast. The vessel has been built for the Peninsular and Oriental Steam Navigation Company, and is sister ship to the *Oceana*, launched from the Queen's Island about three months ago for the same company. Her dimensions are:—Length, 483 ft.; beam, 52 ft.; depth, 37 ft.; the gross tonnage being about 6,500 tons. The vessel is built of Siemens-Martin steel, and will be registered at Lloyd's highest class. The upper decks are of teak, and all the appliances, including windlass, hydraulic lifts, winches, steam steering gear, &c., are of the most modern invention. The *Arcadia* will be fitted up with triple-expansion engines of 6,000 I.H.P., constructed by Messrs. Harland & Wolff, and, as she is intended for passenger traffic between London and Australia, the cabins will be adapted for over 300 first and second-class passengers. Provision will also be made for the accommodation of a large number of third-class passengers. The new vessel will be placed upon the Admiralty list, and in case of war breaking out could be utilised, if necessary, as a fast cruiser or transport. In the latter capacity the *Arcadia* could accommodate 4,000 troops. The vessel will be lighted by electricity. The comfort of passengers will be further promoted by the mechanical ventilation. Refrigerating machines and chambers will also be fitted for the preservation of fresh provisions.

TRIAL TRIPS.

Scorpio.—Last month the trial trip of the steamer *Scorpio* took place, built by Earle's Company, Hull, for the Grimsby and North Sea Steam Trawling Company. She is a similar ship to the *Virgo* and *Libra*, built for the same owners, the dimensions being 97 ft. by 20 ft. by 10 ft. 9 in.; her engines are on the triple-compound three-crank principle, having cylinders 11½ in., 17 in., and 30 in. diameter, by 18 in. stroke, which are supplied with steam of 155 lbs. pressure from a steel boiler. The vessel proceeded to Grimsby, and after the compasses had been adjusted, was taken out to sea, and during the whole of the trial the engines worked in a satisfactory manner, the speed being over 9½ knots.

Peterborough.—The steamer *Peterborough* has lately been taken on her trial trip by Messrs. Earle's Company, Hull. This ship, belonging to Harwich, is owned by the Great Eastern Railway Company, and has been converted from a paddle steamer into a twin-screw. She is 215 ft. by 27 ft. by 17½ ft., and the new machinery comprises two sets of compound diagonal engines, having cylinders 22 in. and 42 in. diameter by 27 in. stroke, and two boilers 12 ft. 4 in. diameter by 11 ft. long, made for a workable pressure of 90 lbs. The vessel has been thoroughly overhauled and been fitted with a saloon, state-rooms, &c., for 60 first-class and 41 second-class passengers. The engines worked most satisfactorily, a speed of 13 knots being attained.

Mersey.—The *Mersey*, second-class steel cruiser, has finished her long series of torpedo trials (extending over several months) at Portsmouth, under the superintendence of Capt. Wilson and the Torpedo Committee. The great difficulty to be overcome in vessels of her great speed is to devise a means of projecting Whiteheads from the under-water broadside tubes when the engines are exerting their utmost power. The method of facilitating the travel of the weapon by cutting indents in the side of the ship was first tried, but as the suggestion proved a failure when subjected to practical experiment a modification of the system fitted on board the *Polyphemus* was afterwards tested. This consists of a shield and a guide-bar, having a groove in which the T-piece of the torpedo slides. The trials have been attended with a fair amount of success, satisfactory runs having been obtained up to a speed of 18 knots. The *Mersey* will return to Chatham.

Brisk.—This vessel has made a four hours' full speed contractors' trial with the forced draught. The trial gave the following results:—Draught of water forward, 12 ft. 6 in., aft 14 ft. 6 in.; pressure of steam in the boilers, 127 lbs.; in cylinders, starboard engine, high, 56·6 lbs., low, 21·6 lbs.; vacuum in condenser, 27·7 inches; revolution of engines, 154·4; H.P., high, 834, low, 1,091—total, 1,925. Port engine, steam in cylinder, high, 58·4 lbs., low, 20 lbs.; vacuum in condenser, 23·1 in.; revolutions, 155; H.P., high, 864, low, 1,018—total, 1,882; for both engines, 3,807. The highest power obtained was 3,903, or 403 in excess of the contract. The mean speed attained was 17·65 knots by patent log, and the highest speed 18·2 knots. The engines worked well and without any hot bearings, and the boilers gave a good supply of steam without priming. The trials of this class of vessel, six in number—called the *Archer* class—are now brought to a close. All these vessels have been built by Messrs. Thomson, of Clyde Bank, Glasgow, and their trials have extended over a period of eleven months. The Admiralty offered the contractors a premium for every H.P. above that contracted for. This class of vessel may be regarded as the fastest in the navy, while their powerful armament consists of six 6 in. guns, mounted on Vavasseur central-pivot carriages, eight quick-firing Hotchkiss guns, and two five-barrel Nordenfeldt machine guns mounted on the bridge, with five torpedo tubes.

Minnesota.—On November 22nd this screw steamer, of the Atlantic Transport Line, left the yard of the builders, Messrs. Harland & Wolff, Belfast, for her trial trip in the Lough. The engines having worked to the satisfaction of the owners' representatives, and the compasses having been adjusted, she proceeded to Barrow to load for Baltimore. The ship is of 5,000 tons deadweight capacity, and is driven by engines of the type known as triplex, having cylinders of the following diameters:—24½ in. 37 in., and 64 in. in diameter, with a stroke of 4 ft.

Lara.—On November 23rd the s.s. *Lara*, just completed by Mr. Charles J. Bigger, shipbuilder, of Londonderry, for the Waterford Steamship Company, went down the river Mersey on her official trial. The weather was exceptionally fine, the results of the trial proving most satisfactory to all concerned. The design of the vessel fulfils all the modern requirements. The first-class passengers are placed amidships in a bridge-house, with entrance-house and smoking-room on bridge deck. The state rooms open off from the saloon, and every attention has been given to the comfort of the passengers. The crew are accommodated in the forecastle forward, and the officers and steerage passengers in the poop aft. Fittings for cattle are placed in all the holds, between decks and upper decks. Messrs. Muir and Caldwell's steam steering gear is placed aft, and the windlass forward. The new machinery, which has been fitted by Messrs. David Rollo & Sons, of Fulton Engine Works, Liverpool, consists of a set of triple-expansion engines, having cylinders 21 in., 34 in., and 55 in. respectively, with a stroke of 36 in. Steam is supplied by two large single-end steel boilers, with three corrugated flues in each, fitted with Henderson's patent firebars, &c. The working pressure is 160 lbs. per square inch; and all the parts of the machinery are fully up to the requirements of the Board of Trade. The engines are fitted with a separate "Bon Accord" centrifugal pumping engine for supplying cooling water to the main condenser. This pump has large connection to the bilges in case of need. A powerful donkey pump has been fitted to deal with the ballast, bilge, and deck water services, and is arranged to turn main engines in dock when steam is down, the feed donkey pump being kept for boiler work only. A "Smillie's" patent feed water heater has also been fitted in the engine-room. The Messrs. Rollo & Sons have fitted two powerful steam cranes for working the cargo, also two steam winches, one forward and one aft, for moving the vessel in dock, steam to crane and winches being had from the main boilers or from the large donkey boiler, which is placed on the main deck inside the engine-room casing. During the day's running everything gave entire satisfaction, the vessel making a speed of 12¾ knots when tried on the measured mile, the engines running at 90 revolutions per minute with the greatest smoothness, and an entire absence of vibration or heating.

Buenos Aires.—On November 23rd the *Buenos Aires*, of Barcelona, built by Messrs. William Denny & Brothers, and engined by Messrs. Denny & Co., both of Dumbarton, went down the Firth of Clyde for her official trials. She is a vessel of 410 ft. by 48 ft. by 32 ft., and is of the citadel deck type. She has splendid accommodation for upwards of 100 first and second class passengers, and her 'tween decks are fitted up for emigrants, of whom she can carry a very large number. Her cargo working gear throughout is on the hydraulic system, as devised by Messrs. Brown, Brothers & Co., Edinburgh. She is fitted throughout by an electric light installation, the dynamo being that of Messrs. King, Brown & Co., Edinburgh, and driven by a compound engine made by the same firm. She is also fitted with a refrigerating machine by Messrs. Haslam & Co. Her engines are of the quadruple-expansion type patented by Mr. Walter Brock. She has cylinders of 32 in., 46½ in., 64½ in. and 92 in., with piston stroke of 60 in. Steam of 170 lbs. working pressure is provided by three double-ended steel boilers. On the measured mile, with the stipulated amount of deadweight on board, she maintained a speed for several consecutive runs of upwards of 15½ knots per hour. She is to be employed as a mail and passenger steamer between Spain and South America.

Kate B. Jones.—On November 30th the new steel screw steamer, *Kate B. Jones*, built by Messrs. Schlesinger, Davis & Co., of Wallsend-on-Tyne, for Messrs. Jones & Thomas, of Cardiff, left the river laden with a cargo of about 2,800 tons, bound for Genoa. The vessel, which has been built to the highest class at Lloyd's, and has scantlings in excess of their requirements, has been superintended during the construction by Captain Thomas, and the engines have been overlooked by Mr. W. Allen, of Cardiff, on account of the owners. Her dimensions are as follows:—Length over all, 279 ft.; length between perpendiculars, 270 ft.; breadth moulded, 37 ft.; depth moulded, 21 ft. 8 in. She is constructed on the cellular bottom principle for water ballast throughout all her holds, and has a long raised quarter deck, surmounted by a short full poop, an extra long bridge forward of the quarter deck, extending to the foremast, with a topgallant forecastle at the fore end, leaving a very short break between. Being specially constructed for coal and grain cargoes, she is fitted throughout with shifting boards, and all possible appliances for facilitating the rapid loading and discharging of her cargo, being supplied with four powerful winches and donkey boiler of unusual size, by Messrs. Clarke, Chapman, Parsons and Co. A direct-acting steam capstan windlass has also been supplied by Messrs. Emmerson, Walker & Thompson Brothers, whilst the vessel will be steered from the midship wheel-house by a powerful steam-steering gear, supplied by Messrs. Allez and MacLellan, of Glasgow, with Hastie's screw gear aft. The main saloon and cabins are under the poop, and the engineers' and officers' quarters are amidships, under the bridge, forward of the engines and boilers. The accommodation for the crew is at the fore end of the bridge. The whole of the cabins, officers' and crew's quarters, as well as the engine-room, stokehold, and, in fact, all parts of the ship are lighted with the electric light, in addition to the ordinary ship's lamps. Under the flying bridge amidships two light towers have been built, in which are placed the side lights, which are so arranged that the ordinary lights or the electric lights may be used. The engines for this vessel have been built under special survey by the North-Eastern Marine Engineering Company, of Wallsend-on-Tyne, and are the direct-acting triple-expansion description, of about 180 N.H.P., and it is expected they will be able to drive the vessel 10 knots per hour. The cylinders are 21 in., 35 in., and 58 in. diameter respectively, by 39 in. length of stroke; whilst two large steel boilers, with a working pressure of 160 lbs. to the square inch, supply steam to the same. All the latest improvements have been concentrated on these engines, which during the trial worked smoothly and well, and developed about 1,000 H.P. effective, and the speed was an average of 9½ knots, without pressing the vessel in any way.

Oakwell.—On December 3rd the s.s. *Oakwell*, 125 ft. by 22 ft. by 11 ft. 1 in., built by Messrs. Craig, Taylor & Co., of Stockton, for coasting trade, and about to be worked by themselves, was taken on the measured mile at Whitley and had a very satisfactory trial trip, a mean speed of nine knots being obtained. The engines are supplied by Messrs. Westgarth, English & Co., of Middlesbro', and are 50 N.H.P., having cylinders 18 in. and 36 in. by 24 in., and gave entire satisfaction during the trials.

Apollo.—On December 5th the new Wilson Liner *Apollo* went on her trial trip. The *Apollo* is a much larger vessel than her predecessor of the same name, also owned by Messrs. Wilson's firm, and which was sunk in the Bay of Biscay by collision several years ago. The new *Apollo* is built of steel throughout. Her dimensions are:—330 ft. by 41 ft. by 29 ft., being of 3,178 tons gross and 2,100 nett register. She is designed to carry 4,300 tons of cargo and 500 tons of bunker coal, upon a draught of 24½ ft. The *Apollo* is rigged as a two-mast brigantine with pole masts. The electric light has been fitted throughout the vessel, and, in addition, there are the usual number of powerful oil-lamps in case the electric light should fail. She will be steered by Messrs. Amos and Smith's apparatus, which has been so contrived that the vessel can be steered either from the bridge or aft, and, in addition, there are powerful hand-steering gear and a special break, so that, if all the other appliances should break down, the rudder could be effectually secured. There are five hatchways and five powerful winches, by means of which cargo can be shipped or discharged. Accommodation is provided for twelve first-class passengers in a saloon placed amidships. In order to ensure the most perfect provision for the safety of the ship and those on board of her, fire-extinguishing apparatus has been fitted to every compartment of the vessel, as well as to the between decks. The vessel is classed 100 A1, so as to secure the Board of Trade passenger and Suez Canal certificates. The *Apollo* has two entire steel decks, and has a turtle-back forward, with a large bridge amidships and hood aft, the latter being principally designed to protect the after steering-gear. The officers and engineers are berthed in a large house aft. The rudder and stern-frame consist of a great casting by Messrs. Jessop, of Sheffield, and the vessel has two deep ballast tanks capable of holding 600 tons, which, of course, can be used for the storage of cargo as occasion requires. Ample appliances have been provided for ensuring sufficient ventilation for all the holds, &c. The anchor will be raised by Messrs. Emmerson and Walker's steam windlass and capstan, and Messrs. Chatburn's steering

telegraph apparatus is used to carry messages from the bridge to the engine-room and after steering apparatus. The vessel has the best charcoal wire rigging. The engines are 250 H.P.N., and they are equal to working up to about 1,700 H.P.I. The engines are arranged on the triple-expansion system, having cylinders of 25 in., 40 in., and 66 in. diameter, with 48 in. stroke. There are two double-ended boilers, 16½ ft. long, 12¼ ft. diameter, which are fitted with eight of Fox's patent corrugated furnaces, each being supplied with Henderson's self-cleansing furnaces. On the trial trip everything went off very well, the engines working splendidly, and far in excess of what was expected, viz., 10 knots per hour, with an expenditure of from 20 to 25 tons of coal per day. A run was made to about 10 miles north of Spurn, and at the luncheon on the return voyage everybody expressed themselves as more than satisfied with the new ship.

Saxon.—On December 10th the Union Steamship Company's new steamer *Saxon*, built by Messrs. Oswald, Mordant & Co., of the Southampton Shipbuilding Works, underwent her builders' trial trip on the measured mile in Stokes' Bay, and attained a mean speed of nearly 10½ knots per hour. She is 148½ ft. long and 24½ ft. beam, with engines of the triple-expansion type, and has been built especially to develop a trade between Cape Town and Knysna and the shallower harbours of the east coast of South Africa, specially with regard to the gold discoveries at Millwood. The *Saxon* will be despatched to South Africa in the course of a few weeks.

Port Fairy.—On December 10th the *Port Fairy* steamer, the latest addition to the Anglo-Australasian Steam Navigation Company's fleet, left the Tyne for her official trial trip. The vessel is 330 ft. over all, 38 ft. beam, and 26 ft. 10 in. depth. She was carefully ballasted with coal in order to get her into light cargo trim, her draught forward being 17 ft. 6 in. and aft 19 ft. The screw was rather pitched for a voyage to Australia than for a maximum run; but during a series of trials at progressive speeds the vessel attained over 13 knots at 70 revolutions. A higher speed was not attempted owing to darkness setting in; but it is thought that, with a finely pitched propeller, the vessel would have reached 13½ to 14 knots. Her indicated power reached 2,181, and the trial trip co-efficient of performance was eminently satisfactory, the vessel having attained one knot higher speed than the *Port Victor* (whose dimensions are the same), although the *Port Fairy's* displacement was 500 tons greater than was the *Port Victor's* at her trial trip. The *Port Fairy* has been built of steel, and engined by Messrs. Wigham, Richardson & Co., of Low Walker, and is rigged as a barquentine. She has accommodation for about 30 saloon and 400 to 500 third-class passengers, and is built to Admiralty requirements for transport service, her fittings throughout being very elaborate. The vessel is eminently adapted for tea carrying, having cargo side ports and a large number of separate holds. The vessel is commanded by Captain Clark, who has been 22 years in his present employ.

Buzzard.—On December 20th the new composite sloop *Buzzard*, which was recently built at Sheerness Dockyard, completed her machinery trial in Prince's Channel. The vessel was tested on a four hours' full-power trial under forced draught, and the results were very satisfactory. The engines worked with great smoothness and developed 2,090 H.P., or 90 in excess of that contracted for. The vessel attained a speed of 14·1 knots.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

MEAN PRESSURE OF A COMPOUND ENGINE.

To the Editor of The Marine Engineer.

Sir,—I have seen many methods for finding the expected mean pressure on the cylinders of a compound engine, but I have not seen any method as yet of any practical value. The practical rule given by Seaton as commonly used by engine makers is, in my opinion, a very rough-and-ready rule, and consequently very wide of the mark. His own theoretical calculation, though somewhat complicated, is worked from necessary data, such as the cut-off in both H. and L. pressure cylinders, clearance, compression, &c., in order to arrive at a more satisfactory solution of the question. I have given the matter some attention during my time at sea, and from a study of indicator cards taken from what I consider the best constructed engines I have been in charge of, I have deduced the following simple rule for finding the mean effective pressure in the cylinders of a compound engine, and also the absolute pressure in receiver. Assuming that the receiver is of the proper capacity, the ratio of cylinders and ratio of expansion should vary with the increase of boiler pressure, and the receiver pressure remain a constant, whether using steam of 80 lbs. or 115 lbs. initial absolute pressure; but better results are obtained from working with steam of the former pressure in the cylinders of a compound engine. Example—to find the mean effective pressure in the cylinders of a compound engine using steam of 80 lbs. absolute pressure, the cut-off in H.P. cylinder being 1·37 and L.P. cylinder 1·64 or ·6, the clearance in both cylinders is equal to $\frac{1}{10}$ of their net capacity, and taking the back pressure in condenser at 3 lbs., the ratio of L.P. cylinder to H.P. cylinder being 3·11, the receiver ·79 to ·8 the capacity of H.P. cylinder. Valve in place. The cylinders are jacketed, the ports and passages of ample size, and an expansion valve is fitted, the allowance for friction, condensation, &c., ·84, and ·83, a factor for finding receiver pressure.

First, to find the receiver pressure, we have

$$1{\cdot}37\ \frac{1+{\cdot}1}{1+1{\cdot}37\times{\cdot}1} = 1{\cdot}31$$

$$\frac{80\text{ lbs.}}{1{\cdot}31}\times\frac{1}{3{\cdot}11\times{\cdot}6} = 32{\cdot}33\text{ lbs.}\times{\cdot}83 = 26{\cdot}83\text{ lbs. in receiver.}$$

Next, to find mean effective pressure, we have—

$$\frac{1+\text{Hyp. Log. }1{\cdot}37}{1{\cdot}37} = {\cdot}959\times 80 = 76{\cdot}72 - (3+26{\cdot}83)\times{\cdot}84 =$$

39·38 lbs. mean effective pressure in H.P. cylinder.

L.P cylinder $1+\text{Hyp. Log. }1{\cdot}64 = 1{\cdot}49\times 26{\cdot}83\text{ lbs.} = 39{\cdot}97\div 2{\cdot}75$, a constant $= 14{\cdot}53$ lbs. mean effective pressure in L.P. cylinder. I may here state that I could find the mean pressure in the L.P. cylinder by a similar method to that used for finding the mean pressure in the H.P. cylinder, by the aid of a table; but in order to dispense with that, and also for the sake of simplicity, I have in preference adopted the above simple and equally accurate method. The above rule can also be applied for working expansively, and gives very correct results with the aid of the following table. In fact, it is impossible to obtain more correct results by rule, for except in the first and second instance, or second and third grades, the result obtained by rule is identical with that found by the indicator cards. By deducting ·5 of a point from the result obtained by rule in the first and second instances, only a correct result will be obtained, that is from the mean found for L.P. cylinder, but it may be neglected altogether.

Expansion Table, &c.

Expansion	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{4}{10}$	$\frac{5}{10}$	$\frac{6}{10}$	$\frac{7}{10}$
Factor for Mean Press.	·95	·86	·85	·84	·84	·84
Factor for Receiver Pressure	·00	·9	·91	·97	·87	·83

Example.—Supposing the engine is now cutting off steam at $\frac{2}{10}$ of stroke, the rate of expansion will be 5 in the H.P. cylinder and 1·6 or ·6 in the L.P. cylinder as before. Then $5\times\frac{1+{\cdot}1}{1+5\times{\cdot}1} = 3{\cdot}65$, so $\frac{80\text{ lbs.}}{3{\cdot}65}\times\frac{1}{3{\cdot}11\times{\cdot}6} = \text{or } 21{\cdot}9\times{\cdot}53 = 11{\cdot}6$ lbs. absolute pressure in receiver, cutting off steam at $\frac{2}{10}$ of stroke in the H.P. cylinder. If we take $\frac{3}{10}$, the process will be similar, with the exception that there will be a factor used for finding receiver pressure, as per table. But to proceed with my calculation in order to show what are the results from working expansively: the ratio of expansion is 5 and the absolute pressure in receiver is 11·6 lbs.

$$\frac{1\times\text{Hyp. Log. }5}{5} = {\cdot}521$$

$\cdot521\times 80\text{ lbs.} = 41{\cdot}68-(3+11{\cdot}6) = 27{\cdot}08\text{ lbs.}\times{\cdot}95$ factor $=$ 25·72 lbs. mean effective pressure in H.P. cylinder.

Now 1 × Hyp. Log. 1·64 = 1·49 × 11·6 lbs. = 17·28 + 2·75 = 6·2 lbs. mean effective pressure in L.P. cylinder. The above results show clearly that there is a decided benefit from working expansively. The mean pressure is increased, especially in the H.P. cylinder by cutting off early as compared with cutting off late; the friction is considerably diminished, the load on the pumps is very much less, and also the weight or load on the crank pins is better equalized, and the condensation of steam is very little, if any, greater, there being less liability to priming, which is generally the case when working full, and there are few but know the bad results which are likely to ensue therefrom.

Now, in order to apply the rule still further, supposing we have fixed on the dimensions of a fairly shaped vessel and her steaming rate per hour. Length between perpendiculars 285 ft., breadth of beam 35 ft., and load draft 22 ft., and she is to steam at sea 10 knots per hour, what horse-power will be required to give out that speed? According to W. Allen's formulæ (with the exception that the facter is suited to the type of vessel) the question becomes $\frac{10^3 \times 285 \times (35 + {}^{2a}44) \times 8{\cdot}7}{20{,}000} = 979{\cdot}4$ horse-power. Now, in order to find area of cylinders to give out this power effectively at a piston speed of 420 ft. per minute, first we have to find the mean pressure. So 39·38 lbs., as already shown, is the mean pressure in H.P. cylinder, and 14·53 lbs. the mean pressure in L.P. cylinder.

$$\text{Then } 14{\cdot}53 + \frac{39{\cdot}38}{3{\cdot}11} = 27{\cdot}19 \text{ lbs.}$$

$$\text{H.P. } \frac{979{\cdot}4 \times 33{,}000}{27{\cdot}19 \times 420 \text{ ft.}} = 2830{\cdot}18 \text{ area of L.P. cylinder.}$$

$$2830{\cdot}18 + 3{\cdot}11 \text{ ratio} = 910{\cdot} \quad ,, \quad \text{of H.P.} \quad ,,$$

or L.P. 60 in. and H.P. 34 in. diameter.

The above rule is perfectly safe, and I am certain that a vessel of the above type at load draft, propelled by a screw 18·5 ft. pitch, with the above H.P. exerted, would steam 10½ knots per hour easily in fair weather. I have calculated and arranged the above rules while steaming along the Red Sea in the direction of Aden, and let me tell you it is rather a hot task in one's cabin at this season of the year.

D. McMILLAN, s.s. *Mekara.*

7th October, 1887.

FORCED DRAUGHT.

To the Editor of The Marine Engineer.

Sir,—Frequent absences from home last month prevented me from sending you, in time for publication in your December issue, a reply to the letter of "The Writer of the Articles on Forced Draught," which appeared in your November number.

The writer of these articles again makes distinct statements in regard to the performances of the *Ohio*, containing various injurious insinuations and misrepresentations.

It is difficult to understand what ideas of responsibility this anonymous writer entertains, when he so jauntily publishes erroneous statements directly fitted to injure, commercially and otherwise, the reputation and progress of the invention he attacks.

The "Writer of the Articles" will find that in this, as in other civilized countries, this mode of attack cannot be indulged in with impunity.

I reget that, in order to counteract, so far, the effect of the injurious statements made by this anonymous writer in your columns, I am under the necessity of showing in detail how far they are at variance with the actual facts.

The first point I notice is the insinuation, again brought prominently forward, that the published statement of results of the official trial was incorrect, and that "this suspicion has been more than confirmed by the results obtained in several runs of the *Ohio* across the Atlantic."

This assertion, in the first place, is a grossly injurious reflection either on the good faith, or ability, of the officials of the company under whose superintendence the trial was conducted, and who supplied the results of the performance of the machinery which were published. In the second place, the performances of the steamer in her runs across the Atlantic, as will be specifically shown further on, go to prove, taking all the different circumstances into account, that the Atlantic performances are even more favourable than that of the official trial.

The second statement of the "Writer of the Articles" which I here notice, is that the breaking down of the fan engine was due, not to fatigue of the engine under a certain period of continuous work, but, save the mark, to a defect in my system, which, according to this writer, interposes "obstructions to the escape of the gases, which become more obstructive when choked with soot."

The fan, it appears, though sufficient at first, after a few days steaming has to be driven much more rapidly to give the supply of air under this growing obstruction, and this the "Writer of the Articles" says, no doubt broke down the fan. This conception is quite unique and altogether amusing, had it not been injurious and untrue. Has the "Writer of the Articles" yet to learn that a fan is driven the more easily the greater the obstruction to the exit of the air, and that the pressure rises without increasing the revolutions, with an increase of obstruction? But leaving argument, what are the facts? The *Ohio* performs the last day's run of her voyage equally as fast as the first—the fan performing the same work as easily on the last day as on the first, and no "soot" whatever accumulates in the "obstructions" under the most ordinary care. In the *New York City*, which is running on her fourth year, and often under steam for months at a time, this "mare's nest," discovered by the "Writer of the Articles," has never yet been found.

Before leaving this point I would call attention to the ingenuity displayed by the "Writer of the Articles" in making the attempt to give a blow to my system over the breakdown of the fans, the means of puffing that of the closed stokehold. It is thus neatly put: "The fans were made by a firm whose reputation is very high for this class of machinery, and there must be, therefore, some cause for them breaking down with this system of forced draught, when fans designed on the same lines and proportions by the same firm have worked with the closed stokehold system for years without giving trouble."

From this it would appear that forced draught on the "more popular plan" of the closed stokehold is, and has been, working in steamers continuously *for years*. Does the "Writer of the Articles" suppose that the readers of your journal know nothing of the extent of the trials of the closed stokehold system? These have been, generally, at full forced draught power of about three hours' duration. In one case I noticed it stated in the public report, as an unusual performance, that a steamer with closed stokehold had actually made on trial a six hours' run at full speed with little, if any, damage to tubes, &c. I believe that with new boilers and fresh water this is possible, but to write of "working for years on the closed stokehold system without giving trouble," is presuming rather too far on the supposed ignorance of your readers.

I would ask the "Writer of the Articles" to give particulars of all the cases he knows where instead of working "*for years*," steamers have run continuously at full forced draught power at sea for 24 *hours* on the closed stokehold system. If he knows of such cases it would be most interesting to have the particulars, with some properly authenticated report of the condition in which the boilers were found after the trials. That there may be no misunderstanding about what is meant by "full forced draught power," let it be taken at anything approaching what the *Ohio* is doing continuously with ease every voyage across the Atlantic.

The "Writer of the Articles" goes on to make a statement regarding the consumption of coal per I.H.P. in the *Ohio*, which is described with the circumstantiality of an eye-witness, though finishing the story with the expression that he believes it to be under the favourable conditions pictured, 1·5 per I.H.P. The incorrectness of this assertion will be shown by the best of all proofs—facts. As is well known by those experienced in the Atlantic passenger service, it is difficult to arrive at a correct estimate of the actual consumption of the propelling engines when steam is being supplied from the main boilers at the same time to a large number of auxiliary engines, and also for cooking and heating purposes throughout the ship, if the total consumption is expressed in terms of the I.H.P. of the main engines only. Being conscious that the more accurately the tests were made the more clearly would my undertaking of 1·25 lbs. per I.H.P. be found about the actual consumption of the main engines at sea, I have been always most desirous of having the actual consumption in the *Ohio* tested by careful weighing over a considerable period. The owners of the steamer have kindly favoured me in doing this by their superintendent engineer, Mr. Doran, and assistants, using all precautions possible to ensure accuracy; and they have furnished me with tabulated particulars of the trial from which I give the results.

The trial took place on 26th October last under the following circumstances and conditions. It was made on the outward passage between Holyhead and Queenstown, and lasted two watches, or eight hours. The sea at the beginning of the trial was compara-

tively smooth, but got gradually rougher, the trial ending in a gale, with the ship running against a head wind and sea. The firemen on first watch had never before worked with forced draught, and consequently had something to learn. On the second watch two of the three firemen had been in the ship on a previous voyage. Three fires were cleaned each watch. Diagrams were taken every half hour, and record of steam pressures on the gauge made every quarter hour. The mean revolutions were taken from the engine counter divided by the minutes of the trial. The mean I.H.P. was calculated from sixteen sets of diagrams taken, each of which was calculated and recorded separately. The I.H.P. taken is that of the main engines only, no allowance being made for the auxiliaries or heating of the ship or steam cooking purposes. The auxiliary engines working during the trial were the following:—The fan engine, the centrifugal pump engine, two Weir's feed engines; all these with full pressure steam, and with reduced steam pressure, the steering engines, double cylinder Worthington pump, electric light engine, also the steam cooking and heating stoves throughout the ship. By an accidental occurrence the metallic packing of the L. P. piston-rod, got out of contact with the rod before starting consumption trial, and was not put in order until after trial was finished, causing a blow of steam every revolution and an in-rush of air whenever the pressure in the cylinder got below the atmosphere. The consequence was that to maintain the vacuum at 26in. the centrifugal pump engine had to be run at 196 revolutions per minute, or about 20 per cent. above its usual speed for 27in. vacuum. Besides the reduced vacuum, the feed water was also necessarily colder than usual. During the first four and a-half hours of trial all the auxiliary engines, the steam cooking, and steam heating throughout the ship were supplied with steam from the main boilers only. For the last three and a-half hours of the trial, after steam had been got up in the donkey boiler, only the auxiliary engines worked with full pressure were supplied from the main boilers. During the first four and a-half hours, though the water in the exhaust steam was for the most part returned to the condenser, the waste of water from the steam throughout the ship was such as to require the feed of the main boilers to be supplemented all the time by water from the sea.

Under above conditions, the mean of the sixteen sets of diagrams of the main engines was 2,144 I.H.P., and the mean pressures of steam on pressure gauge at the half-hours when the diagrams were taken was 147·3 lbs. The mean pressure of the steam during trial on the quarter-hour records was 148·4 lbs., showing that the times at which the diagrams were taken synchronised with periods when the steam pressure was under the average, and consequently they give a power somewhat under the true mean. The total coal consumed *for all purposes* in the main boilers as explained above during the eight hours was 23,856 lbs., or 2,982 lbs. per hour, which, divided by the mean of 2,144 I.H.P. of main engines, gives 1·39 lbs. per I.H.P. per hour. I do not here attempt to make any calculation of the reduction to be made on this item to arrive at the actual consumption per I.H.P. of the main engines alone, and leave this to be done by your readers in the light of the facts stated; but I do believe that few of those qualified to judge will put it at much, if anything, above the 1·25 lbs. of my guarantee, and I will say further that probably no sea-going steamer, on her ordinary voyage, was ever before so carefully and accurately tested as to consumption.

The coals used were South Welsh, put on board in bulk and run out of the bunkers in the usual way, and not "picked," as the "Writer of the Articles" has it, there having been no "picked" coal on board the *Ohio* since she was refitted.

The question which the "Writer of the Articles" raises—Why certain important steamers are being fitted with closed stokeholds, and not with my system?—is not a suitable matter for discussion here; but it is not because of any lack of appreciation of the *Ohio's* performances by her owners, though, doubtless, the break-down of the fan on first voyage gave suitable opportunity for forces adverse to my system to have their way. It may suit certain purposes to play air into a closed stokehold, and call this a system of "forced draught," but I again put it on record that no closed stokehold system can be worked continuously at sea on the rate of combustion per square foot of grate at which my system works without speedy destruction to the boilers, and I do not believe any steamship owners will have the temerity to attempt it.

The depreciatory inferences regarding my system arising from this adoption of the closed stokehold, which the "Writer of the Articles" seeks to establish, are more than rebutted by the fact that another Atlantic company, of the very highest reputation for wise and successful enterprise, have, after a longer trial of my system in one of their mail steamers than the *Ohio* has yet made, have adopted my system for new steamers, which will probably be the largest and swiftest of the coming Titans; and it may surprise the "Writer of the Articles" to know that my system of forced draught is now either fitted or being fitted to passenger and cargo steamers of nearly 80,000 I.H.P.

Time and space prevent me from showing that other remarks made by the "Writer of the Articles" with a view to depreciate my system are as incorrect as those to which I have called attention. Having made this lengthy reply I do not intend to continue this correspondence further.

In conclusion, I beg to mention that an explanation of how the laws of nature are set at defiance by the closed stokehold system, about which the "Writer of the Articles" inquires, will be found in my paper in the "Transactions of Naval Architects for 1886;" but his own description of the effects of the closed stokehold system on the boilers of war ships, after a few hours' run, given in your October number, is sufficiently condemnatory of it, as has been ably pointed out by your correspondents, Mr. Sidney H. Wells and Mr. John P. Matthews, in your issues of November and December last.

I remain,
Yours faithfully,
JAMES HOWDEN.

GLASGOW, *22nd December*, 1887.

FORCED DRAUGHT.

To the Editor of THE MARINE ENGINEER.

SIR,—In reference to Mr. Martin's letter in December issue, I cannot understand what he means by the first part of his letter in reference to H.M.S. *Polyphemus*. It is now a part of history that the originals were condemned, &c., but he must not forget that they were made and fitted on board as an experiment, and were designed by the Admiralty against the advice of the builders; and when the marine type of boilers were fitted, that on the trials, during the evolutions at Bantry Bay and since she has been in the Mediterranean, she has been a thorough success, and done more than she was expected, without any mishap to the machinery, although she has been under forced draught since her trial.

I think Mr. Martin should be more careful in quoting his figures, as in the case of H.M.S. *Anson* he is entirely at sea in stating that she "consumed 60 per cent. more coal in her forced draught trial to produce a bare knot to her natural speed." If he will refer to the official report, he will find that the coal consumption on her natural draught trial was 2·3 lbs., on her forced draught 2·2 lbs. per I.H.P., showing a slight saving.

Several of the writers in your columns lately seem to lose sight of the fact that no man can prove a negative. Until the forced draught system has been tried on a long voyage, it is mere speculation as to the result.

The conditions between the navy and the mercantile service are entirely different. In designing engines for the mercantile service the aim is to proportion them to work economically at their maximum power, while in the navy they have to be proportioned to exert their maximum power in case of emergency; but at the same time, as the greater part of their life is spent in cruising, they must be proportioned to work economically at their minimum speed. I think I am right in saying the eyes of the engineering world are turned to the North at the present time, and anxiously awaiting the result of the two Inman liners, which are to be fitted with closed stokeholds on a larger scale than any of the induced draught system that have been tried. I may say in conclusion that more than two-thirds of navy stokers, whose opinions I have asked, preferred the closed stokehold with from ¾ in. to 2 in. air pressure, to the natural draught, as the stokehold is much cooler, and if the fans are put in the best position, they are not troubled so much with the coal dust.

I remain, Sir, yours truly,
W. G. I.

PORTSMOUTH, *December 12th*, 1887.

POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—In your last issue you publish a letter signed "Progress," the writer of which professes to criticise certain portions of a speech made by me at the opening of the South Shields branch of the Union on the 18th November.

Every speech delivered in public is a fair subject for criticism,

and I am ever ready to respect and reply to a criticism of any of my public utterances, provided Mr. Critic speaks straight out as "Progress" has done, and does not indulge in offensive personalities or cowardly inuendoes written under a *nom de plume*. I cannot but admire the courage, although I may question the prudence, of your correspondent, in entering the arena of literary warfare, when I find that an unfortunate blunder he has made in his letter betrays the fact that he is but a novice in the art of criticism. It is a first essential in a critic that he should have a *thorough* knowledge of the subject he attempts to handle; and a reference to paragraph No. 156 of the regulations for Exams. of Masters and Mates, which says that exams. in steam are *voluntary*, will show your readers wherein "Progress" has given himself away. Your correspondent says that I "wanted to know why engineers should not be allowed to *dabble* in navigation just as much as masters were allowed to dabble in steam." I still want to know this, but I want to know more—and that is, why they should not be allowed to *pass* in navigation, if they desire it, as masters are now allowed to pass in steam; and I intend to repeat that question as often as I get the chance to do so. I do not assert that engineers *ought* to pass in navigation; it is only a question of fair play, and might be easily settled by withdrawing the permission given to masters by the regulations to obtain an extra certificate in steam.

I am of opinion that it would look quite as well for an engineer to be taking the sun as for a captain to be taking charge of the engines, and I rather think the engineer would have the best of it either way. The use of the word "childish" by your correspondent in connection with this subject as applied to his brother engineers is not to be commended, as it is treating them with disrespect, and ought to be withdrawn. The examination proposed for engineers before being allowed to go to sea for the first time I distinctly stated to be one in *workmanship* and *practical* knowledge of the marine engine and boiler; and when the time arrives for appointing examiners, the Union will experience no difficulty in finding amongst its members a sufficient number of competent men to fill the position, seeing it includes in its present membership chief engineers of some of the largest steamers afloat who have qualified for these positions by the same course as the present examiners of the Board of Trade have qualified for their positions.

It is very kind of "Progress" to suggest that I should get certain science class papers, &c., and compare them with the papers now in use at Marine Engineers' exams., but if he knew my daily occupation he would probably admit that I already know sufficient of them for any ordinary purpose. The proposal that donkey men or men in charge of boilers should pass an examination and obtain a license is not mine, it was only referred to by me as one of a large number that had been submitted to the Union for their consideration, and a well-known case of a disastrous explosion was cited by me as an illustration of the *necessity* for some better security being provided for the lives of engineers and others than exists at present. It is absurd to talk about the chief's duties in reply to such a proposal until some one has invented a method of enabling a man to be present in several different places at one and the same time, a task that will probably be accomplished the week after perpetual motion has been discovered.

I am afraid "Progress" has "wasted his sweetness on the desert air" in pointing out to me that my (?) "restriction policy by exams., &c., won't do in these days of Free Trade." I refuse to be turned from the error of my ways by him, until he has converted the Board of Trade and made them give up their present "restriction policy by exams., &c.," which he says won't do. When he has succeeded with the Board of Trade I will be glad to reconsider the matter upon hearing from your correspondent to that effect.

The letter concludes by asking me several questions about other societies, which he had better ask at the societies themselves, as I have no time to attend to the business of any society but our own.

I have replied thus far to the questions of your correspondent because he is straightforward and entitled to respect, and because I was led to understand that a reply would be expected from me by many of your readers, but I must decline to answer any further questions from this same correspondent. I can only say to him, If the Union does not suit you leave it alone, it will try and get along without you; and I may further add, for the information of your general readers, that any genuine marine engineer desiring information regarding the Union will receive most courteous treatment by calling at the chief offices, or a prompt and civil reply if he applies by letter, but no information will be given to any other persons except upon application by letter, which will be submitted to the Ex. Committee, who will decide what information shall be given.

The progress of the Union is now much more rapid than formerly, thereby showing that it is becoming better known, the number of members registered at the date of my last letter being 1,005, and it is now over 1,240, or an increase of 240 in a month. There are several more branches about ready for being formally opened, but they are postponed until the holidays are over, when I expect to have the pleasure of again addressing you.

I conclude by thanking you for your courtesy, and wishing you and all your readers the compliments of the season, and

I remain, yours very truly,
THE HON. CHIEF SECRETARY,
Marine Engineers' Union.

Chief Offices,
91, Minories, Tower Hill,
London, E.
20th December, 1887.

THE MARINE ENGINEERS' UNION.

To the Editor of The Marine Engineer.

Sir,—Your correspondent M.I.M.E. and A.I.N.A., with his pertinent questions, would like to force the idea upon us that he takes a great interest in the formation of the Union, and it is a great pity that he was not consulted before we dared to start. Let us see how much interest this *great man* does take in the Union. From his letter it is evident he has been too lazy to read the rules or even the circular, or he would have seen there names of honourable men, and men that any profession might be proud of, who constitute the council. Yet, poor fellow, he can only see the secretary. There are none so blind as those who won't see. All his questions he will find answered in the rules, except the one regarding the papers read and discussions. I don't think I would take the trouble to enlighten him on this point were it not for other readers more interested. I can only speak for the Newport branch. We have spent there many very pleasant evenings, and have had some very interesting discussions. The subjects have always been the building up of the Union, with the exception of one evening, when we had under our consideration whether it was desirable to allow foreigners to obtain certificates in this country, seeing that we are not allowed to do so in theirs; and I consider that was for the building up of the Union also. I must admit we have not made such rapid growth as he thinks we should; we are not yet in a position to enlighten the world as those societies to which he belongs to do. They are considerably older than we are, and have flourished their trumpets and blowed their bags a good many times. We have other fish to fry at present; we must command the respect of the world before we undertake to enlighten it. We must firstly prove that we know what we want; secondly, that we have some idea of getting that want supplied; thirdly, that we have a determination to secure for ourselves that position due to our high calling, as the backbone of the British mercantile marine. Then we will enlighten our worthy and interested friend, and many others who are sitting in darkness.

Some of the correspondents in the November number advise calm language and coolness, &c. But how any man can stop in his skin, to say nothing of being calm, when men of the class of M.I.M E. and A. I. N. A. attempt to prove that the hundreds of engineers who have joined the Union were so dull as to know so little about it as he does. Again, he shows his interest by so earnestly begging for a disclaimer from you, Sir, for fear it should help it in any way by it being thought you were connected. The fact of the matter, in my opinion, he has no interest; however, he has failed to show it. He talks very big about paying the secretary, but he has not seen his way clear to contribute his 5s. I wonder how he could afford to pay more? You may depend upon it, brothers, that he belongs to that class which we have before heard about, who have built steamers, and have forgotten to put any accommodation for engineers, not even a place to lay their heads, and then pushed them in the bunkers. Very much interested in engineers! Then, again, for a man of his kind to attempt to throw discredit on our hon. secretary, a man who has proved his interest in engineers by the unselfish manner he has given his time, his energy, and ability to our cause for love (yet I am one of those who think that we should pay him, and we shall be bound to do it some day, as another man like him we should have some trouble to find. There is a lot of human nature in most men; I shouldn't like to work for no wage), it is unbearable. Let us rally, brothers, close around him, and prove to him that we are able to appreciate his noble efforts.

Just a word to those engineers who are waiting for the honour of being the last to join. If this Union fails in its object it will

be your fault. It is only a matter of principle you are asked to express. From a financial point of view it is nothing—less than ½d. per day. Fitters working ashore pay 6 per cent. to support their trade.

Now it amounts to this: if you won't join, owners will take it that we are satisfied with our position, and the next thing we might reasonably expect to hear of would be further encroachments on our rights. Now is our time; let us help ourselves. I intended, Sir, being brief, but somehow or other, I don't know how, I can't do it. Hoping you will find room,

I remain yours, &c.,

SELF-HELP.

Newport, *Nov. 9th*, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—If the letter of M.I.M.E. and A.I.N.A. was *not* written in personal animus to Hon. Chief Secretary, it is very difficult to understand in what spirit it was written. If writer *is* member of Marine Engineers' Union, the papers each member received prior to joining, and letters which have appeared in MARINE ENGINEER since, show the progress of Marine Engineers' Union has scored one thousand!!! If, on the other hand, writer is *not* member of Marine Engineers' Union, although he may be member of Institution of Mechanical Engineers and Associate of Institution of Naval Architects, then his questions are the essence of *impertinence*. I do not believe any member of Marine Engineers' Union has faintest desire that "marine engine builders" or "owners" shall become members—unless they are seagoing engineers, certificated by Board of Trade. Such admission would be a gross deviation from sense in which Marine Engineers' Union was founded and promoted, and would ostracise its integrity of being for certificated seagoing men only. I trust the Committee and Hon. Chief Secretary will not so far forget the dignity of their office as to reply in columns of MARINE ENGINEER to questions posed by an *anonymous* writer, which any member can get answered by application at offices, 91, Minories; and I do hope I shall be excused in expressing the belief that the "scepticism" of any one individual member of Institution of Mechanical Engineers and Associate of Institute of Naval Architects is suppositious and superfluous in the face of actual facts the Hon. Chief Secretary has produced to Marine Engineers' Union. Upon every occasion when I have addressed MARINE ENGINEER, I have followed the good old English practice of firing my gun and running up my flag—informing your readers who I am and where I live—admiring and following out the reply of the boatswain to the gunner "shot for shot, and d—— all favours;" and cannot but think it would be more thorough—I might say, more honest—if such course was generally adopted.

I have the honour to be, Sir,

Your most obedient humble servant,

RICHARD A. J. COPE,

Working Marine Engineer, No. 20,517.

Sas-lez-Ostende (Belgium),

18th November, 1887.

THE MARINE ENGINEERS' UNION.

To the Editor of THE MARINE ENGINEER.

SIR,—Judging from the twenty-seven lines of vituperation that Mr. Leask was pleased to devote to me (as "M. I. M. E. and A. I. N. A.") in your last issue, I should think that my "stab in the dark" (as he recklessly and without the least foundation attempts to stigmatise my effort to elicit information) has evidently touched a tender point in the organisation of the M. E. Union.

We all know the old legal maxim, "no case abuse, &c." Surely, Mr. Leask's case is not so weak that he must perforce descend to abuse? Let us hope not.

I fully agree, Sir, with your editorial comment at the foot of Mr. Leask's last letter, and many others are also equally surprised at his method of evading the questions asked in mine. Will he, now that he is in possession of my name and address, give us the information asked for, or will some other stumbling block present itself? I rather think the latter.

I "plead" no "excuse" for writing anonymously, nor is any needed, a fact perfectly well known to Mr. Leask, who, as is evident by the flattery he has bestowed upon "Eastern Mail Company's Engineer" and others who have written anonymously, apparently is not at all averse to replying to a nameless correspondent, provided always that the nameless one sides with him.

I wonder if he will deign to notice the letter by "Progress" in your last issue, or will he also "consign" that "to the limbo prepared, &c.?" No, no, Mr. Leask, be consistent, and either "consign" all your anonymous correspondence "to the limbo," &c., or deal with it all round alike. Only, please *don't* treat me to the very flowery and "polished in style, faultless in logic" effusiveness which characterises most of your epistles, but give me plain answers to plain questions. Remember, that we can agree to differ, and that we are perhaps not all as much taken up with the "Union" as you are. As Mr. Leask scorns praise (when it doesn't come from an "E. M. Co.'s Engineer,") perhaps he is also too immaculate for advice; but I would tell him that if he expects his Hon. Chief Secretaryship is going to be a bed of roses he is vastly mistaken; and even he, great man as he is, will find, like everybody else blessed with an "official title" (big phrase that! Thank goodness, I haven't got one!) that he will have to take the rough with the smooth, or knuckle under to those who will.

As I said in my previous letter, the H. C. Sec. is a perfect stranger to me, and it was not until his last letter that I even knew he was in business. Perhaps I lack the modesty which he appears to so abundantly possess; but I should say that the sending out of 26,000 circulars, bearing my own name and the address of my own place of business, was a very effectual way of advertising it. However, as he is in business, the fourth paragraph of my previous letter comes more to the point than ever; and if modesty is such a great point with the H. C. Sec., would it not have been better at the outset to have secured other premises than his own business ones for the purposes of the "Union?" Surely a "Union" already in receipt of £1,005 per annum, and having no official salaries to pay, could spend a fair amount over its headquarters.

Assuring Mr. Leask that I have not suffered much from his declining to treat me as an honourable man, and trusting that he will not immolate my modest patronymic on the shrine of his splenetic wrath,

I remain, Sir, yours obediently,

F. SEATON SNOWDON.

23, ANDALUS ROAD, CLAPHAM, S.W.

P.S.—With your permission, I will, in your next issue, return to the theme which induced me to write my first letter, namely, that in my opinion the "Union" does not adequately uphold the honour and interests of an honourable and influential profession, and therefore does not sufficiently tend to raise the professional status of marine engineers. F. S. S.

Reviews.

Handbook for Steam Users. By M. Powis Bale. London: Longmans, Green & Co.

MR. BALE's present handy little book may be said to be the outcome, on an enlarged scale, of a "Chart of Rules for Engine Drivers," designed to hang in engine rooms, and published by him some years ago.

This chart had an extensive circulation, and the demand for it led the author to embrace the present opportunity of revising and adding to it chapters on steam engine and boiler management, and on steam boiler explosions, the matter being condensed as much as possible, and arranged in the form of paragraphs for easy reference.

After a careful reading of the book, we can unhesitatingly recommend it to all who have charge of steam engines and boilers, and we are confident that if the book was in the hands of all such, and was carefully studied by them, that we should hear a good deal less of those disastrous explosions that are now only too frequent in their occurrence.

We have only noticed two trivial errors in the book. Thus, on p. 51, in the table of the areas of circular segments, column 5, ·199 is given, where it should evidently be ·099; and on p. 55, reference is made to "the unshaded portion on the upper part of the figure," although no figure is given in the book. With these exceptions, the book is well meriting of praise, and we trust it may meet with ready encouragement from all steam users.

Smith's Tables and Memoranda for Mechanics, Engineers, &c. By Francis Smith. London: Crosby, Lockwood & Son.

THE fourth edition of this handy little book of reference is now before us, and from a personal experience with the first edition, extending over nearly five years, we cannot speak too highly of it.

It is a veritable engineer's *multum in parvo*, for though small enough for the waistcoat pocket, it yet contains some 240 pages of useful information culled from the most modern and trustworthy sources.

No engineer or mechanic ought to be without the book, for in time alone we have found it save its cost (1s. 6d.) many times over in a single week.

It is well and copiously indexed (a matter of importance with all books of reference), clearly printed on a thin, strong paper, and serviceably bound in leather, with rounded corners, to facilitate its introduction into and removal from the waistcoat pocket.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from November 18th to December 15th, 1887.

15810 D. McQueen. Boiler furnaces.
15833 W. Malcolm. Shipping, &c., coal.
15834 Do. do.
15842 W. B. Thompson. Receiving screw propeller shaft thrusts.
15861 T. F. Braime. Oil cans or feeders.
15869 W. R. Hayes. Side port or scuttle ventilators.
15870 H. Fletcher. Drums of windlasses.
15877 J. B. Willis. Indicating position of ship's rudder.
15880 H. C. Vogt. Propelling ships.
15908 T. Huard. Non-emitting smoke or other vapour in steam engines and boilers.
15915 D. Williams & W. E. Raymond. Steam engine reversing gear
15925 J. H. Schofield & A. V. G. Worth. Light-feed lubricator valves.
15930 A. E. Seaton. Forcing the coupling bolts out of marine engine propeller and other shafting.
15953 F. H. Street & C. Ellis. Collapsible bed and berths.
15976 J. Reid. Pump.
15977 R. P. Fuge. Shaft speed indicator.
16011 R. Horsburgh. Furnace for steam boilers.
16037 H. F. Alexander. Anchor.
16050 S. H. Wilson & W. Kermode. Steering apparatus for yachts, &c.
16067 Haddan (P. F. E. Carré). Steam engine packing.
16082 W. H. Blakeney. Steam cylinder valve and valve gear.
16096 W. Leach. Mechanical stokers.
16122 S. M. Y. Valdivielso. Life saving jacket.
16162 M. Immisch. Hydraulic motor.
16197 J. Russell. Ship's boat.
16255 F. E. Clotten. Boats.
16288 E. Lawson. Ships' berths.
16293 L. Sterne. Air forcing apparatus for steam vessels.
16308 J. Beynon. Boat detaching hook.
16338 R. S. White. Ships.
16385 S. & F. Thompson. Joints for cylinder covers, steam chests, &c.
16410 P. Brownley. Lubricators.
16420 R. H. Heenan. Spherical engines.
16428 A. R. Leask. Automatic ship steering signals.
16431 Redfern (F. S. Cormier, W. H. Johnson & J. P. Angrove). Ships' jury rudders.
16470 G. Taylor. Shipping coal.
16530 D. Wilson. Ships, boats, barges, buoys, &c.
16541 S. Reid. Steam engine lubricators.
16644 C. A. Cousin & J. Brindley. Signalling at sea.
16651 D. B. Hutton. Metallic packing.
16687 J. J. Peck. Deck set and water ballast lifeboat.
16688 A. Higginson. Direct action winches.
16690 R. Pickwell. Signal lights on ships.
16714 T. Thorbiornsen. Discovering ships' leaks.
16754 J. D. Allen. Life buoys.
16782 Lake (W. W. Dashiell). Steam boiler furnaces.
16833 B. W. Stevens. Line throwing with gun, &c.
16850 R. Pearson. Lifeboat deck seats.
16874 T. J. Moore. Power increasing gear for engines, &c.
16879 W. P. Hoskins. Ships' berths.
16887 J. A. Rowe. Waste steam condenser.
16939 F. G. M. Stoney. Anti-friction thrust bearings for screw propeller shafts.
16986 E. B. Ellice-Clark & L. Chapman. Pumps.
17009 J. Sarvie, Junr. Steam pile driver.
17029 J. M. Vanzini. Lubricators.
17065 S. Eddington & J. E. Steevenson. Re-heating steam between high and low pressure cylinders.
17172 T. O'Rourke Jameson. Sail hanks.
17240 J. C. Jopling. Purifying and circulating water in steam boilers.
17269 F. W. Cannon. Steam winches.
17272 J. D. Morton. Putting off ships' boats.

BOARD OF TRADE EXAMINATIONS.

NOTE.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

November 26th, 1887.

Allan, J. R. .... 2C Aberdeen
Fairhead, Wm. A. 2C Sunderl'd
Fairley, Thos. .. 1C ,,
Forsyth, David H. 1C ,,
George, James M. 2C Aberdeen
Gerrie, Wm. H. 2C ,,
Harrison, Thos. 1C Sunderl'd
Hendrie, Arch... 1C London
Houston, James.. 1C N.Shields
Hunter, Robt J. 2C Sunderl'd
Johnston, D. M. 1C Leith
Lawrence, F. T. 1C Aberdeen
Mearse, Benj. .. 2C ,,
Mussett, Alex. W. 1C Sunderl'd
Palmer, Richd... 1C ,,
Pool, Joseph W. 1C ,,
Roscoe, Wm..... 2C ,,
Schulze, Fred. .. 2C Liverpool
Smith, Joseph .. 1C London
Storms, Peter M. 2C Liverpool
Taylor, Robert .. 2C Sunderl'd
Thompson, Foster 2C ,,
Wakeham, Jos. B. 1C Liverpool

December 3rd, 1887.

Back, Robert.... 2C Glasgow
Barden, G. T. .. 1C N.Shields
Brunswick, Robt. 1C ,,
Dickie, Robt..... 1C London
Dixon, Robert. C. 1C Liverpool
Drysdale, John.. 2C Glasgow
Findlay, David.. 1C ,,
Galbraith, Thos. 1C ,,
Haberland, G. B. 1C London
Hattersley, A. G. 2C ,,
Hodge, William 2C Glasgow
Holbech, Alfred 2C London
Hunter, Arch. .. 2C Glasgow
Ingram, Matthew 2C N.Shields
Marshall, John .. 2C Glasgow
McLuckie, Robt. 1C ,,
Millar, John ..... 1C Liverpool
Milner, Wm. G. 2C Belfast
Muir, John .... 2C Glasgow
Richardson, H... 2C London
Rowe, James..... 2C Glasgow
Ryan, Frank A. 1C N.Shields
Scott, Robert..... 1C N.Shield
Scott, W. H. ... 2C ,,
Sumner, T. C. .. 2C Liverpool
Wylie, John .... 1C Glasgow

December 10th, 1887.

Beveridge, R. J. 1C London
Crowe, Percy B. 2C ,,
Forbes, Maxwell 1C Leith
Hay, Archibald 1C Liverpool
Kilgour, Wm. .. 1C Leith
Kinnear, George 1C ,,
M'Intosh, Peter A. 1C ,,
Melville, Andw. S. 2C ,,
Moir, Norman .. 2C ,,
Pratt, John .... 1C Liverpool
Ramage, Alex... 1C Leith
Watson, James.. 2C Liverpool
Wray, Edwin .. 1C Hull

December 17th, 1887.

Brown, James .. 1C Greenock
Brown, Nicholas 1C N.Shields
Bulman, Wm. .. 1C ,,
Campbell, M. .. 1C Greenock
Daniel, John.... 2C Liverpool
Douglas, David.. 2C Greenock
Falconer, Geo. D. 1C N.Shields
Harding, Edwd A 2C London
Kay, David J. .. 1C Liverpool
Langhorn, Richd. 2C Hull
Lawson, Wm. J. 1C London
Lee, Ernest A. .. 2C ,,
McBride, Andrew 2C Greenock
McKibbin, John 2C Dublin
Millar, Robert A. 2C Greenock
Molyneux, T., jun. 1C Liverpool
Moore, Wm. A. 2C London
Murdock, John J. 2C Liverpool
Murray, Charles 2C ,,
Perrott, Wm. Thos. 1C London
Reid, Thos. H... 1C Greenock
Reid, William .. 1C ,,
Sara, Howard .. 2C Plymouth
Stevenson, Wm. 1C Greenock
Thomas, John J. 1C Plymouth
Thompson, Arthur 2C Dublin
Voyce, Abraham 1C N.Shields
Wilson, John .. 2C Greenock

The Marine Engineer.

LONDON, FEBRUARY 1, 1888.

EDITORIAL NOTES.

THERE seems to be much diversity of opinion as to the accurate deductions of the Board of Trade Surveyors from the burst steam pipe of the *Elbe*. The representatives of the Board of Trade have thrown the weight of their experience in favour of the theory that either the copper of the pipe was cracked while the pipe was overheated in the process of brazing, or the process of rounding and planishing produced incipient flaws, which, on the pipe being again put on the fire for the purpose of brazing, caused the flanges to extend and receive the distinctive discoloration noticed in the fractures of the pipes. The makers, however, Messrs. Oswald, Mordaunt & Co., of Southampton, do not concur in these conclusions, and apparently have, what they consider, a well-founded belief that such accidents may arise from accumulation of water. The evidence of overheating does seem to depend almost entirely on an expression of opinion on the part of the Board of Trade inspectors, and to have been adopted for want of a better; and as there is no evidence of the thin taper edges of the pipe, which would earliest show burning, having been at all wasted, or any part of the same having been drained of solder, the conclusions of the Board of Trade inspectors do appear to be somewhat not proven. So much importance do Messrs. Oswald, Mordaunt & Co. attach to the water theory, that they have provided for such dangers for the future by fitting a water trap on the main steam pipe as near as possible to the point where the pipe gave way. The receiver is of large capacity, and it had to be emptied no less than five times during the last trial trip of the *Elbe*, showing, as a matter of fact, that water did collect in the pipes to a large extent. It will be remembered, also, that on the 19th of September, when the disaster occurred, the engines were under slow steam for some time, and also stopped for above an hour. These circumstances would all be favourable to a conclusion of water in the pipes. This accident has altogether been one of the most interesting character, and all the lessons to be learnt from it have not, in our opinion, yet been discovered.

No sooner has the Manchester Canal become an accepted fact, and the works in good progress, than Sheffield now begins to cry out for a similar accommodation. When, however, the absolute facts of the case are considered, we must begin to recognise that the demand for an easy and inexpensive outlet to the sea for our large manufacturing towns is not merely a fad, but an absolute necessity for their continued existence. Where the staple trade of a town is in heavy steel and iron goods, such as rails, plates, boilers, engines, carriage by railroad is heavy enough to kill the profit in these times of severe competition. We estimate that in this class of work, carriage by railroad will not be much less than 20 per cent. on the whole wages value paid. If, then, an estimate is made of the average amount of wages per annum paid in Sheffield, the enormous effect upon a cheap or expensive transit of the goods so manufactured will be better realised. The Dronfield steel works were moved by Mr. G. Wilson, with his accustomed sagacity, from the Derby town to the Solway shore, thereby effecting a saving in railway carriage rates of something like £100,000 per annum. If, then, an easy and inexpensive outlet to the sea can be obtained for such a town as Sheffield, it will mean a great extension of life for her manufacturing industries, or an enormous economy in those at present carried on. It is thought that a canal to Goole, capable of taking 200-ton ships, which would bring the raw material to Sheffield, and take the finished product to the vessel from whatever port the latter might be situated, would answer all requirements, and it is believed that such a waterway could be cut for about £1,000,000. We trust this scheme may turn out practicable, as every fresh departure of this character which may have the effect of cheapening production, helps England to a still better foreign market than at present. Birmingham also is considering the same question, one to construct a canal to Bristol, and the other to the North Sea. Birmingham already has a waterway system in connection with London, and if the existing canals were enlarged so as to allow of the passage of powerful steam tugs and 30 to 40 ton barges, this might meet the requirements of water carriage to the port of London. The matter is already before the Birmingham Corporation, and it is quite likely that some practical result may ensue. If this rage for water communication with the coast should continue, England will find herself with quite a new and important branch of an inland commercial marine.

We are glad to see that at last the United States are succeeding better, if we may trust details of their own reports, in the manufacture of iron or steel cruisers for their navy. We notice an account of the trial of the steel cruiser *Chicago*, which has been long delayed, but which took place in the month of December. The test

to be given was to be of a thorough character, namely, a continued trial for six consecutive hours at full speed. Everything seems to have gone off very successfully, even from the first start, the course set out being from Long Island Sound, three hours in one direction and three hours in the opposite direction. The vessel was controlled entirely by steam-steering gear, which appears to have worked with complete satisfaction, as the control of the vessel was perfect in the hands of one man in the pilot tower on the forward bridge. Chief engineer Thomson and his staff of assistants took entire charge of the machinery, and took indicator diagrams, condition of the vacuum, and revolutions of the engines every thirty minutes, upon the result of which the captain in charge and the chief engineer, Mr. J. W. Thomson, have sent in detailed reports. These reports seem to be of a very favourable character, and the machinery seems to have exceeded the requirements of the contract. No hitch occurred during the six consecutive hours' trial, as during that period the speed was not allowed to slacken. The mean speed of the engine seems to have been 69·3 revolutions per minute, with a development of a mean I.H.P. of 5,084. The maximum for one hour reached 5,248 H.P, with a corresponding maximum speed of 16·83 knots. The mean speed throughout the trial is reported as 15·1 knots. This result, on the whole, seems very much more favourable than what had latterly been anticipated from other results of vessels built and engined in the United States. No doubt the United States constructors have now profited by their late experience, and are probably taking some hints in construction from the results of so many years' experience which the British Admiralty have had. We should think it likely that what standing defences the United States are disposed to maintain will hereafter consist rather of a navy than an army, and probably the *Chicago* and other vessels now in construction may prove the nucleus of a powerful fleet, which will some day take an important position in the arbitrement of Europe.

The *Benbow* is now approaching completion, and will shortly be brought down from Chatham to Portsmouth for a trial of her great 111 ton guns. The *Benbow* will then represent one of the most powerfully armed vessels in the British or any navy. It is, however, a matter of regret for some critics that these splendid guns should be mounted in open turrets, and thus be considerably exposed to an enemy's shot. The principal dimensions of the new 111 ton gun are as follows:—Total length, including breech gear, about 45 ft.; calibre, 16¼ in.; extreme diameter, 65½ in.; length of bore, 487½ in., or about 30 calibres. We need hardly remind our readers that these new guns are now all breechloaders and constructed of steel, and they are made with a chamber of larger diameter than the rifled bore of the gun. A comparison between the modern ordnance now afloat and the most powerful pieces that Great Britain possessed at the close of the Crimean war, only about 30 years ago, is somewhat startling. The heaviest gun then known was the 10 in. cast iron S. B. gun, whose total length was 128 in., and whose total weight did not exceed 86 cwt. The proportion of weight of charge and shot, as compared with the weight of the gun, is still on the increase, with the improved material and methods of construction, the proportion at present of foot tons of energy per ton of gun being 519 for the 111 ton Elswick gun. This result seems considerably to beat anything that has as yet been produced, being even in excess of the results, measured in that way, of the 119 ton Krupp gun, which has long been considered the finest heavy piece of ordnance in existence. If we were half as well to the front in our light field guns as we seem to be in the heavy ordnance of our ironclads, England would hold a very prominent and foremost place in the power of her armaments. As the size and unwieldliness of our naval guns increases, the complications of machinery necessary to load, fire, and control the guns must also necessarily increase to bring them within the power and manipulation of the crews. The 111 ton Elswick gun is no exception to this rule, and the duplex arrangement of Stanhope levers, carrier and cam lever at the breech, form quite a bewildering maze of mechanical contrivances. The lifting, loading, and traversing of the gun will be performed on board the *Benbow* by hydraulic power, the breech of the gun being depressed beneath the steel deck for receiving its charge.

British and German Built Vessels in the Chinese Navy.—A writer in a Chinese journal (who is probably an officer of the Chinese navy and of the squadron itself) describing the four vessels, two built at Elswick and two at Stettin, which left Portsmouth in August last for China, concludes by instituting a comparison between them. The displacement of the German boats, he says, is 3,100 tons, as against 2,300 tons of the English, still they only carry two 21 centimètre and two 6 in. guns, against Armstrong's three 21 centimètre and two 6 in. guns, besides an auxiliary armament of vastly superior importance. In speed there is an enormous difference. The German ships only attain a speed of 15 knots, while the English have reached nearly 19 knots. Again, in the protection against an enemy's fire, it appears that the turtle steel deck of the English ships is considerably superior to the vertical armour of the German ships. The German armour is laid on in three strakes, only 30 in. deep, and consequently liable to be easily broken across by a moderately heavy projectile. The upper strake is 8 in. thick, the lower two 6 in. only. The English armoured deck, if measured horizontally, is 8 in. thick, without taking into account the special properties of sloping armour for deflecting shots. The workmanship in general, and particularly the blacksmiths' and shipwrights' work in the German vessels, is very rough indeed.

PROGRESS AND DEVELOPMENT OF THE MARINE ENGINE.*

(*Continued from page* 300.)

By FRANK C. MARSHALL, Esq., Member of Council.

In regard to the weight of machinery required for the production of a given amount of power, there has been since 1881 but little progress made in the Mercantile Marine, except in a few individual cases; and the writer ventures here to impress upon shipowners and engineers generally the necessity of paying greater attention to this important subject, as in all cases in which deadweight cargoes have to be carried; and, judging from the great importance attached at the present time to the position of the load-line, it would appear that the majority of cargo vessels are engaged in deadweight carrying, every reduction in weight of propelling machinery and bunker coals means the increase of freight-earning power of the vessel. For instance, if we consider a vessel carrying a deadweight cargo of 2,500 tons, and having an I.H.P. of 1,000, according to the data given in Mr. Hall's paper, her propelling machinery would weigh 204 tons. Now, if this could be reduced by 25 per cent., this would mean that the vessel could carry 51 tons more cargo, that is to say, she would have an increase of carrying capacity of 2 per cent., and since the working expenses would not be increased, this would give considerably more than this increase in the profits, whilst a larger reduction in the weight would give a proportionately larger benefit.

The following are similar particulars of engines made by the writer's firm:—

Name.	Date.	I.H.P.	Weight of Engine per I.H.P. in lbs.	Weight of Boilers and Water per I.H.P. in lbs.	Total Weight of Machinery per I.H.P. in lbs.
Tsukuski ..	1881	2,887	147	115	262
Protector ..	1884	1,646	109	127	236
Esmeralda ..	1884	6,282	119	128	247
G. Bausan ..	1884	6,000	114	122	236
Naniwa	1885	7,720	98	106	204
Panther	1886	6,984	76	100	176
‡Dogali	1887	8,045	78	90	168
‡Isla de Cuba ..	1887	2,700	70	89	159
†Tripoli	1887	4,200	34	50	84
‡Sardegna ..	Now building.	22,800	83	95	178
‡†Montebello ..		4,200	35	49	84
‡No. 2,093 ..		4,200	60	74	134
*Express		2,800	145	128	273*

This result has been achieved in the boiler department principally by the more complete adoption of forced draught, whereby we now get 20 and even 22 I.H.P. per square foot of grate, and in the engine department by use of higher speeds of piston and revolution, made possible by the more general employment of the high class material now available in the construction of the engines.

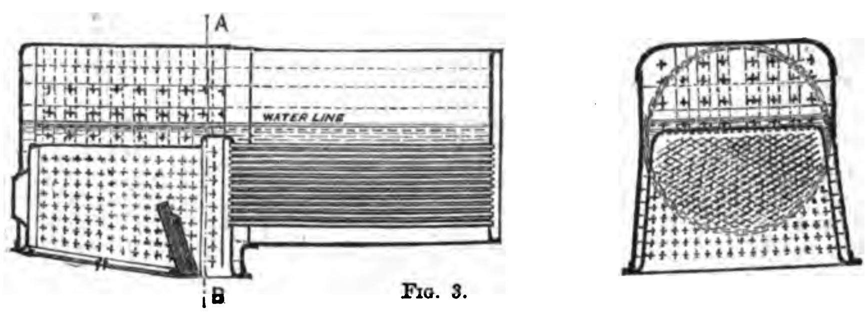


FIG. 3.

In war vessels, however, the progress in matter of the rates of power and weight has been marked and continuous, as may be seen from the following particulars of machinery supplied to Her Majesty's ships, which have been kindly furnished by Mr. R. Sennett, the Engineer-in-Chief of the Admiralty:—

Vessel.	Date.	I.H.P.	Weight of Engines per I.H.P.	Weight of boilers, including water, per I.H.P.	Total Weight of Machinery per I.H.P.
			lbs.	lbs.	lbs.
Iris	1880	7,330	136	173	309
Canada	1882	2,430	152	211	363
Satellite	1882	1,400	134	177	311
Conqueror ..	1883	5,840	145	166	311
Colossus	1884	7,490	151	178	329
Edinburgh ..	1884	7,520	143	169	312
Imperieuse ..	1885	10,180	130	140	270
Rodney	1885	11,160	105	127	232
Leander	1885	5,500	139	196	335
Mersey	1885	6,630	82½	104	186½
Surprise	1885	3,030	112	149	261
Scout	1885	3,370	78	116	194
Benbow	1885	10,850	112	158	270
Howe	1886	11,725	104	116	220
Calliope	1886	4,024	113	175	288
Now building—					
Racoon	..	4,500	85	105	190
Medusa	..	9,000	..	..	161
New Rattler ..	..	1,200	..	..	244
Daphne	..	2,000	..	..	215
Sandfly	..	3,000	..	..	82½

As regards the weights of the boilers, when referring to forced draught I have already indicated that when economy of fuel is not of first importance, very great reduction in weight is obtainable by this means, and that even when economy is of the first importance this principle is attended with economical results, even when accompanied by reduction in the size of boiler; but so long as the present type of boiler is used in our Mercantile Marine, and the present scantlings be insisted on, we shall not be able to make so great a reduction in boiler weights as might be done by the adoption of, say, the locomotive or some other type. As regards scantlings, however, the Admiralty have taken an important step. Instead of applying the stereotyped rules and regulations properly applicable to boilers designed to work at from 30 to 60 lbs., and which required the hydraulic test pressure to be double that of the working pressure, to those now constructed for 150 lbs. pressure, they have adopted a system similar to that adopted in Germany, of testing boilers to 90 lbs. in excess of their working pressure instead of to double the working pressure, and of regulating the scantlings by the test pressure. On this principle, if a boiler be made with the scantlings arranged by the older method for 150 lbs. working pressure and to 300 lbs. testing pressure, it would be approved of for a working pressure of 210 lbs. per square inch instead of 150 lbs., an increase of 40 per cent. in the working pressure; and affording the means of obtaining the advantage and economy arising from the use and application of steam of 33 per cent. higher pressure say in engines of the quadruple-expansion system.

It is with regard to types of boilers, however, that there is the greatest room for improvement, the modified locomotive form having now proved itself to be far better adapted to continuous work than it was at one time considered to be; the objections formerly urged against its use no longer hold good, while its lightness, and the small quantity of water it contains, as com-

* Read at the Twenty-ninth Session of the Institution of Naval Architects, July 26th, 1887; the Right Hon. the Earl of Ravensworth, President, in the chair.

* The *Express* is a merchant vessel intended to attain a speed of 17 knots.
† These vessels have each 6 locomotive boilers.
‡ These vessels have triple-expansion engines; all the others in the table are two-cylinder compound.

pared with boilers of the ordinary type of the same power, are advantages much in its favour.

The objections previously urged against this form of boiler were its comparative inaccessibility and the wear and tear due to insufficient circulation. As regards the latter point, the modifications recently made in the design have completely removed those objections; these are shown in the accompanying drawings. Fig. 2 shows boilers as first made for the *Polyphemus* and several vessels of the Royal Italian Navy. From their construction it will be seen that in these boilers it was difficult, if not impossible, to keep the water spaces round the furnaces fully supplied with water, the evaporation in these spaces when under even natural or very slight artificial draught being excessive; unless provision is made for a complete and continuous supply of water to replace that evaporated and that carried away by the ebullition, the plates must become over-heated and distorted, and cause stay-ends and tubes to leak.

The boiler shown in Fig. 3 represents a boiler which has proved very successful in working, and evidences great care in design; the provision for free movement of the various parts under excessive varying temperature and consequent expansion and contraction is very perfect, but even in this form the writer thinks more complete provision for circulation of water would be an advantage, especially when the grate surface is large. This boiler, however, gives satisfaction for grate surfaces up to about 40 square feet.

The modified form in Fig. 4 shows the water spaces carried partly under the ashpit. These have proved to be far more efficient as regards circulation than those in 1 or 2. Fig. 5 shows the boiler now generally used. In them the complete water space under the ashpit has so much improved the circulation that it has given no trouble whatever; and although this construction adds slightly to the weight, its advantages are so great that the writer's firm has adopted the type in all recent boilers of the class that they have made for sea-going torpedo cruisers. Fig. 6 shows a somewhat similar type of boiler as fitted in the *Rattlesnake*. In this boiler it will be seen that the firegrate is interrupted by the vertical water tubes forming the central water spaces. Fig. 7 shows the peculiar way in which the end plates have been stayed in some torpedo-boat boilers in order to give accessibility to the inside of the boiler, which is impossible with boilers stayed like those represented in Figs. 1 to 5. This method of staying, the writer respectfully submits, indicates a method by which nearly all the objections to the locomotive type of boiler is removed.

As regards accessibility of the interior parts of the boiler, this is mainly required for cleaning purposes, and its necessity is, therefore, primarily a question of boiler management. So long as scale is allowed to accumulate in boilers, so long will it be essential to have them easily accessible; but the adoption of higher pressures is already leading to the abandonment of the older methods of working, and to the adoption of the principle of supplying only distilled water to make up waste, so that no scale can form in the boiler. At the high temperature of steam at 150 lbs. pressure, all the lime salts contained in sea-water are necessarily deposited as scale, and apparently in boilers working at these pressures, the scale is deposited more on the furnaces and less on the tubes than is the case in boilers working at low pressure, and unfortunately the furnaces are the parts least able to withstand a coating of non-conducting scale upon them. Several failures of boilers through the furnaces becoming coated with scale, without the boilers being salted up in other parts, have led to the introduction, in long voyage steamers, of distilling apparatus for producing a supply of pure water to make up the waste which takes place, as before alluded to.

The Admiralty have long adopted the principle of double distillation for this purpose in all vessels fitted with boilers of the modified locomotive type, and lately in all other new vessels. In these double distillers the distillation is effected by means of the heat from steam taken direct from the boiler, the condensed water from this steam being returned to the boiler. The evaporation takes place under a partial vacuum, and the distillate being condensed in a separate condenser may be used either for dietetic purposes or for supplying fresh water to the boiler. When the latter object only is required there is no need for a separate condenser apparatus, as the evaporated vapour may be conducted direct to the main engine surface condenser, while on another plan, which commends itself both for simplicity and for economy, the evaporation may take place under ordinary atmospheric pressure. In the former case, the evaporation being effected at a lower temperature than in the latter, a less supply of steam from the boiler, and a less amount of heating surface in the distiller, is required, but the loss of heat is greater; in other words, the evaporation worked under atmospheric pressure is the more economical of the two. Fig. 8 shows the method to which I allude. The sea water to be evaporated is supplied from the circulating water or the main engine. The steam for supplying the heat is obtained from the drain-pipe from the steam-jacket, which is fittep with a cock so that communication may be made either direct, or through the apparatus, to the drain tank, which is provided with

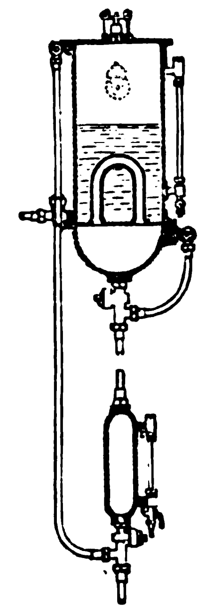


FIG. 8.

a glass water-gauge, and which serves also as a drain to the steam from distiller. The evaporated sea water is led by a pipe into the pipe leading from the drain tank direct to the hot well, and the heat imparted to it is therefore not lost, being employed usefully in heating the feed water; whereas in the case of the distillate being passed into the condenser, the heat has to be extracted by the circulating water, and is wasted. The amount of heat thus used, depending upon the amount of extra feed required, cannot be very great if the machinery and boilers are properly managed, as the loss of fresh water should be very small. But if the figures given by Mr. P. Hall in his paper may be taken to represent an average case, so that the water of an ordinary boiler becomes changed in eight or ten days' steaming, indicating that about 2 per cent. of the total evaporation is lost, the question of the expenditure of fuel required to make up this loss is one that should not be lost sight of.

Whatever form of distiller is used, there can be no doubt that the economy attending the greater evaporative efficiency of the boiler owing to the heating surfaces being kept clean, will of itself amply repay the relatively small cost of the apparatus.

The plan of supplying boilers with pure water to make up the waste is essential to the economical working of long voyage steamers, and will no doubt be extensively if not universally adopted in all sea-going vessels with high pressure boilers; and if this method of working boilers becomes general in our Mercantile Marine it will remove the greatest obstacle to using smaller and lighter boilers, and thus open a way for considerable reduction in weight.

As regards the engines themselves we must follow the lead taken by the Admiralty, and look to high speed of piston and of revolution, and to the use of high class material for the moving parts and framework, as being the principal way in which we may effect a reduction of weight in proportion to the power developed. Something also may no doubt be still done in this direction by improving the efficiency of the steam by careful consideration of proportions of cylinders, degree of expansion, sizes of ports, &c.; the latter point, sometimes overlooked, being important in all engines, but especially so in those of high speed, too large ports occasioning loss of efficiency of steam from the too great clearance spaces, while too small ports also occasion loss, from the great wire-drawing of the steam in its passage into and out of the cylinders; but the main improvement must be looked for in the directions indicated.

In some quarters, unfortunately, prejudice against high speed engines continues to exist, as they are considered to be necessarily wanting in strength, and to be uneconomical both in propulsive

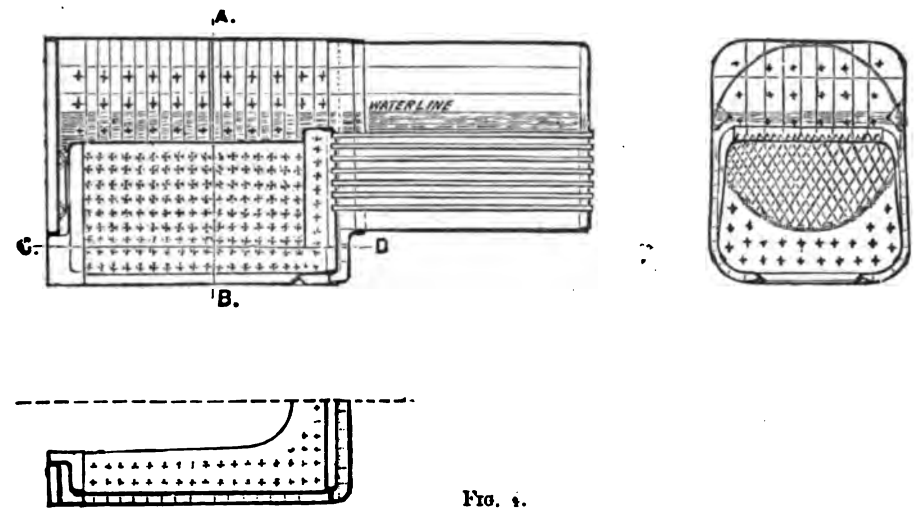


Fig. 4.

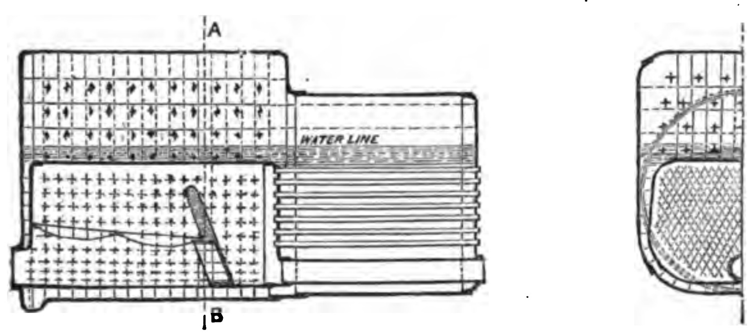


Fig. 5.

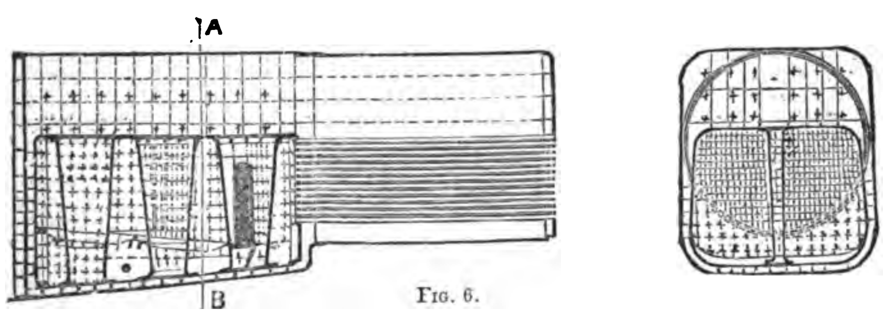


Fig. 6.

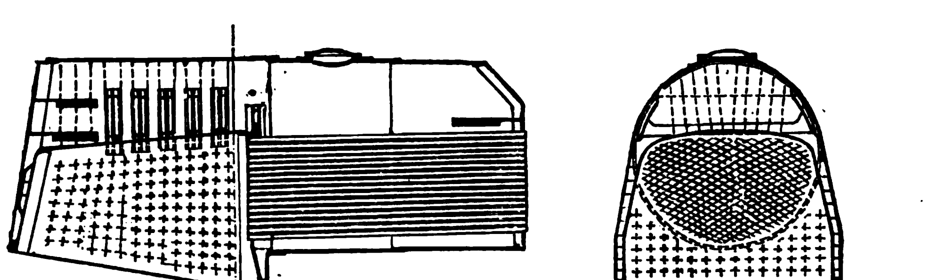


Fig. 7.

efficiency and as regards wear and tear, but these prejudices will no doubt disappear in time. Such engines, to be successful, must be carefully designed, the strength and surfaces of every part being proportioned to the loads coming upon them, and, moreover, the momentum of the moving weights must be properly balanced. If these points are provided for there is no reason why fast running engines should not be economical in all respects.

It must be borne in mind that the strength of an engine, like that of a chain, is the strength of its weakest part, and that consequently excess of weight and strength in the other parts are merely extra loads which the vessel has to carry unprofitably during the whole of her existence, so that a heavy engine does not necessarily mean a strong engine, nor even an economical one.

As regards the use of high class material, plates of mild steel of such weight and dimensions as a few years ago could only have been made at great cost by the special plant used for rolling armour plates, can now be obtained from steel makers at reasonable rates. Forgings of steel made from a single ingot can now be obtained of almost any size and weight required, and castings of steel are now produced of dimensions and forms which were previously unobtainable and considered impracticable.

Notwithstanding the progress already made, there are good reasons to believe that our metallurgists have not yet exhausted all their resources, and that we will shortly be able to obtain for use steel—or rather iron—alloys both in castings and in forgings, combining strength and ductility to degrees far exceeding those now in use. In bronze or copper alloys also we have now at our disposal metals of far greater strength and ductility than we had a few years ago.

As regards wear and tear of engines, it must be borne in mind that speed is not the only factor to be considered. In all machinery, if undue wear of surfaces is to be avoided, they must be made of proper materials, accurately finished, and be proportioned to the loads coming upon them; and when this is done, and an efficient constant automatic system of lubrication is fitted to all the working parts, little need be feared from this cause. In our own experience we find that with piston speed of from 800 to 850 ft. per minute engines have run as sweetly and as free from heating as when run at half that speed, and that the wear of brasses, &c., at this speed is as inappreciable as in engines designed to work at lower speeds.

The other point mentioned, viz., propulsive efficiency, is one which experience shows may be equally assured with speeds of revolution much in excess of those now common in the merchant service. The particulars of screws given by Mr. Linnington at the last meeting show that a high propulsive efficiency may be in large heavy vessels with fast running screws, whilst, going to extreme limits of speed, the wonderful performances of torpedo-boats would not be possible unless their propellers were nearly as efficient at high as at low speeds.

Taking a broad view of the position, therefore, it may reasonably be expected that the near future will see further progress on all points connected with marine engineering; and although at the present time the requirments of the Mercantile Marine are in many respects different from those of war-vessels, so that the points striven for, and considered to be of first importance in one case, may not be of so much consequence in the other, yet, as in many respects they have much in common, we may expect that in such matters as economy of fuel, &c., the Mercantile Marine will take the lead, and the designers of war-vessels will profit by the experience thus gained, so in matters connected with the production of power on a minimum weight war-vessels will always be to the fore, and will give us experiences which, if we are wise, we shall apply and make the most of.

The writer cannot close this paper without acknowledging the great service rendered to himself personally in its preparation by his friend and colleague, Mr. James Milton, Member of Council, without whose valuable help he could not have completed it, or responded in any way to the highly complimentary request of the Council, expressed through his Lordship the President.

PLATTER'S ROCK.—The Admiralty have instructed Mr. F. M. Cotton, their resident engineer, to survey Platter's Rock, in Holyhead Harbour, with a view to its entire removal. The disappearance of this dangerous obstacle would render Holyhead one of the safest and finest harbours in the world. It is estimated that the removal would cost £1,000,000. The execution of this work would do more than anything else to help the London and North-Western Railway to develop the shipping trade at Holyhead, and intercept much of the business which now goes to Liverpool, and may go through the canal.

WATER GAS.

MR. A. WILSON, Gas Furnace Engineer, Stafford, whose name is well known in connection with gas producers and furnaces, is now introducing the manufacture of a kind of gas hitherto but little known in this country. It is known as water gas. This gas is made for incandescent lighting, and other uses, and it is a question whether it would not prove an economical method for illumination on shipboard in some such form as that adopted in railway carriages. Water gas generators are made in small as well as large sizes; and in the case of ocean going steamers there could be no objection to weight or bulk of plant. For the purpose of illumination water gas possesses an advantage over the electric light, no machinery being required. The cinders from the stoke hole, if passed through a screen, with the clinkers picked out, would be the proper fuel for the production of water gas. The incandescent light produced has a steadiness and brilliancy not possessed by the electric light; while, from a given photometric power, the cost of installation and maintenance is much smaller. Water gas may be employed for incandescent lighting; for firing furnaces; for heating, cooking, and for driving gas engines. In short, it is suitable for all the applications of light and heat. Water gas is a product of the decomposition of steam, in the presence of incandescent fuel. The reaction giving this result has been long known; and there results from it carbonic acid, carbonic oxide, and hydrogen. The adaptation of the gaseous mixture to light and heat is American, and it had its origin in necessity. America is but indifferently provided with the coal best suited for the manufacture of lighting gas, while it possesses in exceptional abundance anthracite and petroleum bye-products. Water gas thus resulted in America from the utilization of the petroleum bye-products and anthracite. Anthracite having provided the incandescent fuel, in whose presence steam is decomposed, the carburetting of the resulting water gas consisted in adding one of the hydro-carbons, by any of the well-known methods. The Granger apparatus is one of those methods, and consists in heating the mixture to as high a temperature as possible in a regenerator. A second method consists in passing the water gas through a series of highly-heated retorts, which contain residuum of petroleum, naphtha, &c. A third method consists in passing the water gas through incandescent coke, after the admixture with a hydro-carbon. The first process has received the name of its inventor, Lowe; the second, that of Tessie du Motay; the third is known as the Strong process. These processes, unfortunately, produce soot, and, in addition, they, at a low temperature, condense a great part of the carburetted matter.

The operation of the Lowe process is as follows:—The generator, fitted with a grate, is first filled with anthracite, and heated up by a blast—the blast being introduced beneath the grate. The gas therein produced is next burnt by means of air introduced at the top. When, by this combustion, the generator becomes sufficiently heated, an operation which takes from ten to fifteen minutes, according to the force of the blast and the size of the hearth, the valve to the chimney is shut, and steam is admitted below the grate. At the same time refuse petroleum, naphtha, or similar matter, is introduced by a pump into the passage between the generator and the regenerator. The steam, in traversing the mass of the fuel, is converted into water gas, when it passes along with the petroleum vapour into the heated regenerator, where it is converted into a fixed gas. On issuing from the regenerator as a fixed gas, it passes through a condenser of the organ pipe type. As regards the production, the apparati of the three systems are about equal. According to the experiments of Andrear, of Vienna, one kilo of anthracite and one kilo of petroleum yield one cubic metre of gas, which produces double the lighting power of ordinary coal gas.

The generator for heating furnaces and boilers to make 20,000 ft. per hour is about 8 ft. in diameter by 22 ft. in height. Several of such generators have been for some time at work at the Wilkowitz Iron Works in Austria, where they have given unqualified satisfaction. In that use the water gas has been applied to the re-heating furnaces in the rolling mills, which previously had ordinary hand-fired furnaces. At these furnaces it has been found that to do the same work as before, 1,330 cubic ft. of water gas per hour has replaced 1 cwt. of coal. In the steel melting furnaces the consumption of water gas is 600 c.m. per ton of steel made (= 22,000 cubic ft.); and in the billet furnaces the consumption is 270 c.m. (= 10,000 cubic ft.) per ton of steel billets rolled. Where the water gas is produced in large quantity it is a mistake to allow it to escape into the atmosphere if there are

other uses to which it may be applied. It is then nearly free from carbonic acid, and may be used with advantage in heating steam boilers, as is commonly done with waste blast furnace gas. It, moreover, serves equally well, either in its ordinary state or mixed anew with water gas, for melting or re-heating iron, or alternately in furnaces with or without regeneration. For illumination the water gas flame heats a comb of little magnesian rods. These at once assume a whiteness which is much superior to the incandescent electric light, being without the bluish tinge of the arc lamp. The light, besides, possesses the advantage of absolute steadiness, this following from the circumstance of a mass of matter in an incandescent state requiring an appreciable time to cool, and thereby to exhibit change of flame. In order to obtain the same quantity of light by water gas as by coal gas, it is necessary to consume like quantities, the advantage being in the greater light power of the water gas. With a consumption of 150 litres per hour (= 5·3 cubic ft.), a magnesian comb gives at first a photometric power of from 20 to 22 candles, after fifty hours it gives but 15 candles, and after 100 hours only 10. The comb costs 1½d. each, so that their consumption costs about a farthing per hour. The burners used are the same as for town gas, and so are the globes and all the fittings.

It should be added that steam, in passing through red hot carbon, produces a mixture of carbonic acid, carbonic oxide, and hydrogen, in which mixture the proportion of carbonic acid varies according to the temperature of the mass of heated carbon when the steam is passing through it. If this temperature is high enough there is no carbonic acid produced at all, only carbonic oxide and hydrogen, so that the water gas obtained is composed theoretically thus:—

	By Volume.	By Weight.
CO	50 per cent.	94 per cent.
H	50 ,,	6 ,,

As the temperature decreases the proportion of carbonic acid increases, while the proportion of carbonic oxide decreases, and finally the result is the production of a gas composed thus:—

	By Volume.	By Weight.
CO_2	33 per cent.	92 per cent.
H	66 ,,	8 ,,

Carbonic acid passed through carbon begins to be decomposed into carbonic oxide at a temperature of 550° C., and at a temperature of 950° C. the production of oxide rises to 94 per cent., while at 1,000° the transformation is complete. Similar results are obtained on passing steam through incandescent coke; at a temperature of 500° C. its decomposition to hydrogen and carbonic acid is complete. From 1,000° to 1,200° C., the carbonic acid is converted into carbonic oxide. The whole reaction is, therefore, as follows: The decomposition of steam produces hydrogen and carbonic acid, and by continued contact with incandescent coke, the carbonic acid is transformed into carbonic oxide. For steel melting and steam raising, the cost of the water gas is a little less than one halfpenny per 1,000 ft. For illumination the cost is sixpence per 1,000 ft.

FEED HEATERS.

With the adoption of the very high pressures of steam now in common practice with triple-expansion engines, and the consequent high temperatures that the engines and boilers are subjected to, the necessity has arisen for some account to be taken of the strains and other effects produced by these high temperatures.

The limit of temperature has nearly been attained, which renders gun metal an unsafe material for stop valves and other parts exposed to the live steam from the boiler; and recent experiments made by the Admiralty and Board of Trade and by several of the leading engineering firms of the country, clearly demonstrate that at not far above the present working temperatures, copper loses in strength and will have to give place to a more refractory metal for steam pipes, if the pressure of steam goes much beyond 200 lbs. The *Elbe* accident proved that brazed copper pipes are a source of danger even under present temperatures; and already several manufacturers have fitted up plant to produce solid drawn copper steam pipes of ample dimensions for our largest engines. The universal adoption of mild steel in the construction of boilers is due to the high-working pressures of the day; and the greater care bestowed both in the design and workmanship of modern marine boilers, compared with but a few years since, may also be traced to the same cause. In addition, however, to excellence of design and workmanship and the suitability of material in the construction of boilers, one thing more is needed, and that is, that the boilers shall be so worked as to prevent the formation of any scale or other impediment to the rapid transfer of heat from the plates of the heating surface to the water, and also to reduce the differences of temperature that exist in various parts of the boilers to a minimum. The surface condenser practically allows of the boilers being continuously fed with water from which all saline matter has been extracted; and when this is supplemented by an evaporator or distiller for converting sea water into fresh water to make up for any losses that may arise in the boilers through leakages, donkeys working, &c., there should be no excuse whatever for any other than fresh water being used to feed the boilers with. A deposit of grease on the heating surfaces of a boiler is almost as bad as a thick scale, and has in several cases, through its non-conducting nature, allowed of the plates becoming red hot and the fire box to collapse. With high-pressure steam little or no lubricant is required for the pistons and slides; and the invention of the sight-feed lubricator has enabled the engineer to so regulate the supply of oil to the actual needs of the internal working parts of the engines that only a very inappreciable amount of greasy matter should ever enter a boiler.

We have next to consider what steps have been taken for equalising the temperatures throughout the boiler. If we take a glass test tube and fill it three parts full with water and then apply a bunsen flame to the bottom of the glass, we find that in a very short time the water boils and is equally hot through the whole length of the tube. If instead of applying the heat at the bottom of the tube, the tube had been inclined at an angle of 30 degrees, and the flame then applied to the middle, we should now find that while the water at the surface was boiling, that at the bottom of the tube remained quite cold. This is due to the fact that water is an exceedingly bad conductor of heat, and that a mass of water can only be thoroughly heated by convection. An internally fired marine boiler corresponds to the test tube of water with the heat applied half way up the tube; for while the water may be boiling at a temperature say of 360° F. in the upper part of the boiler, yet in the lower parts beneath the furnaces the water will remain at the temperature at which it entered the boiler, and which under ordinary circumstances is about 80° or 100°. We thus have the top plates of the boiler at a temperature of 360° while the lower ones are at 100°; and, therefore, while the top plates have expanded the amount due to the rise in temperature of some 260°, and which amount is an appreciable and measurable quantity, the lower plates remain in their normal state. This unequal expansion throughout the boiler sets up strains which make themselves recognised in the weakest parts, namely the joints; and although the best workmanship may have been put in the riveting and caulking, yet after a very short time the seams in the bottom of the shell begin to leak, and become a source of constant worry and anxiety to the engineer.

The cylindrical type of boiler used for marine purposes precludes the possibility of having them fired externally, in which case the source of heat being below the lowest water space the whole of the water would become equally heated. It therefore follows that some other means must be adopted, to ensure having perfectly tight boilers, of heating the water in the lower part of the boiler. This can be done most easily by heating the feed water before it enters the boiler. A simple method of obtaining hot feed water is well known to engineers by working the condensers hot. The objections to this plan being adopted on an extensive scale are so great that none but the most stupid of men would think of following it. In the first place, a hot condenser means a poor vacuum, and therefore a great loss of power in the engine is the result. Again, a hot condenser is followed by the gradual salting up of the tubes on the water side, until at last the scale becomes so thick as to prevent the condensing of the steam at all. And lastly, very few of the ordinary feed pumps of marine engines are capable of pumping water at a much higher temperature than 130° or 140° into the boiler from the hot well. A much more reasonable method of heating the feed water is to have it carried through a long coil of feed pipe fitted in either the uptake or the steam space of the boiler, its temperature being very considerably raised during its passage through this coil or pipe. This plan, however, finds but little favour amongst engineers. A separate feed heating apparatus is found to be the best means of getting hot water in the lowest part of the boiler, and there is scarcely a vessel of the mercantile marine that is fitted with triple-expansion engines that is not also now fitted with a feed heater; in fact, a feed heater is considered an essential part of the outfit of triple engines in the merchant navy, although their

importance has not been very largely recognised in the Royal Navy up till the present time.

Feed heaters may be divided into two classes. The first comprises those in which the *desideratum* is to raise the temperature of the feed water to the highest possible point, without any regard to effecting an economy of fuel. The second class includes all those heaters in which the economy of fuel is the chief object aimed at, the equalisation of temperatures in the boilers being of less importance. In the first class the heating agent is live steam direct from the boiler, while in the second, the heat is obtained from one or other of those two great sources of waste heat in a steam engine, namely, the products of combustion escaping up the chimney, or the exhaust steam on its way to the condenser. In most land engines, and up till recent times in marine engines, the feed heater was fitted in the root of the chimney and consisted of a coil of pipes through which the water was forced on its road to the boiler, or of a tank fitted with tubes through which the heated gases passed, into which the water was delivered by the air pump, and from which it was forced by the feed pump into the boiler. This plan is found to be inconvenient for marine purposes, and part of the exhaust steam from either the high, intermediate, or low pressure cylinders is now generally utilised for heating the feed water with a view to economy of fuel. In addition to raising the temperature of the feed, feed heaters possess several other good points. If by the use of the extra make up on the hot well, or through any of the condenser tubes leaking, the feed water contains any saline matter, precipitation of the lime and other salts will take place in the heater and not in the boiler; and thus a source of danger is done away with in boilers. The voluminous reports of the Boiler Committee place it beyond doubt that the chief cause of the corrosion of boilers is the presence of moist air in them. All water absorbs air at ordinary temperatures but expels it when heated. Therefore, by heating the feed to boiling point before pumping it into the boiler, we can get rid of nearly the whole of the air it held in solution: and feed heaters therefore tend to prevent corrosion in a boiler and to considerably prolong its life. This will also diminish the quantity of zinc that is required to preserve the boilers, and in this respect alone should prove a boon to engineers. The presence of air in the water and steam in a boiler is detrimental also in another way. Air is a bad conductor and absorbent of heat; and its mixture with water prevents a very rapid heating of the water. In all heaters means are provided for allowing the liberated air to escape—there being generally an air pipe led from the heater to the hot well. By using feed heaters the condensers may be worked at the temperature which gives the best results, and the full benefits of a good vacuum derived; and the air pump valves are not so likely to be rendered inefficient as when the condenser is worked at a high temperature. The effect of heating up the feed water before it enters the boiler is to promote a much better circulation of the water in the boiler; and with a better circulation a more rapid generation of steam follows as a natural consequence. A steady and continuous circulation of the water in the boiler will also do much to lessen priming—this evil often being solely caused by a want of circulation. In ships fitted with a donkey boiler, the feed heater can also be used for causing a circulation of the water in the main boilers during the time that steam is being raised in them, and so allowing of the full pressure being more quickly attained than under ordinary conditions, and that, too, without producing any unnecessary strains on the boiler.

Several feed heaters have been described in this journal from time to time, and a study of them will convey to the mind the general principles upon which these important fittings act.

In those heaters in which the heating of the water is only aimed at, they simply form as it were a sort of air vessel for the feed pumps. With all forms of heater, it is necessary that they should be fixed as high up in the engine-room as possible, so that the water may flow down by gravity into the feed pumps in some descriptions, or into the boiler with other types of heater.

When desired for simply heating the water, the feed is taken from the hot well by the main feed pump and forced into the top of the heater, where it is broken up and falls to the bottom over a series of discs or other heating surfaces. Steam direct from the boiler enters the lower part of the heater through a perforated pipe, and boils the water there, so that in a very short time the same pressure of steam exists in the heater above the water as in the boiler. The water in the heater can only rise to a certain height, when it enters an overflow pipe leading direct into the boiler, the force of gravity due to the height of the heater being sufficient to overcome the weight of the feed check valve on the boiler and to allow of the water entering the boiler. Heaters constructed on these principles can be made to raise the temperature of the feed to within 10° of that corresponding to the pressure of steam; but to do this a very large quantity of extra steam has to be generated in the boiler which cannot be used for doing work in the engines. Taking the boiler pressure to be 150 lbs., the temperature corresponding to this is about 360° F. The latent heat is easily calculated and found to be about 850. If the water in the hot well is at 100° F. and be raised by the feed heater to 350° F., then if N be the number of lbs. of feed water that 1 lb. of steam from the boiler will raise to 350°, we have

$$N \times (350° - 100°) = 850$$
$$250\,N = 850$$
$$N = 3{\cdot}4$$

That is, we require 1 lb. of steam to go to the feed heater to warm up every 3·4 lbs. of water; or, in other words, out of every 4·4 lbs. of water evaporated in the boiler only 3·4 lbs. can be employed in doing work in the engines. Of course there is no heat lost, because all the heat of the steam in the heater passes back again to the boiler; but on the other hand, it is clear that if it is desired to bring the feed water up to nearly the temperature of the steam by using boiler steam for this purpose, then larger boilers will be necessary than are so where feed heaters are not adopted.

(To be continued.)

TRADE IN 1887.

ENGINEERING.—MESSRS. MATHESON AND GRANT'S REPORT.—Trade has continued to improve during the last three months; there has been a marked increase in the value of exports, and in most branches of engineering the prospects for the opening year are favourable. The introduction of late years of automatic and labour-saving machinery has much to do with the low prices that prevail, for while the volume of trade has increased the producing power of the country has grown still more rapidly.

IRON AND STEEL SHIPBUILDING.—A marked recovery has taken place during the last few months from the depression of the preceding three years, and this improvement is the most significant sign that a general revival has at last commenced in the engineering trades. In Scotland shipbuilding reached its *maximum* in 1884, when nearly half a million tons were launched; freight rates rapidly fell under the increased competition of shipowners, and in 1886 less than 200,000 tons were built. Although the recovery has come too recently to influence much the statistics of the year just closed, the contracts entered into since September aggregate a greater tonnage than has ever been given out in a similar period. Steel has at last entirely superseded iron as a material of construction for steamers, for while in 1879 only 10 per cent. of the total vessels built were of steel, in 1887 the proportion was 80 per cent., and the remainder were almost entirely sailing vessels. In boilers the same revolution has taken place; steel allows the higher pressure of steam which is essential to economy of fuel, and further progress in this direction is going on. Triple expansion has been successful with steam at 150 lbs. pressure, but the same principle carried out by quadruple expansion will be still more advantageous if an initial pressure of 200 lbs. be given in the first of the four cylinders. This is likely to be the *maximum* till invention takes a new departure.

JOHN WHITE'S ANNUAL SHIPPING REVIEW.—The tonnage added to the register during the past year is about 565,000 tons, and removed from the register 595,000 tons. These totals in both cases include respectively vessels bought from and sold to foreigners. Of this production the Clyde has built 185,362 tons, being an excess of nearly 13,000 tons over 1886; the Tyne 93,071, an excess of over 10,000 tons; the Wear 84,483 tons, an excess of nearly 28,000 tons; the Hartlepools 53,457 tons, an excess of over 38,000 tons. Although the Clyde total exceeds the previous year, it must be remembered 1886 was the smallest output on that river since 1868, with the exception of 1877, when the production was restricted by a very long strike. The Hartlepools have had an exceptional share of the past year's work, although the total has been exceeded in previous years. The Mersey has only built half the tonnage of 1886, and the Thames may almost be looked upon as a ship-building river of the past. Of the above quantities about 30,000 tons of shipping has been built for foreigners, who have also produced about 58,000 tons abroad. The year commenced with improved prospects, several builders having secured a fair amount of work, but a very quiet time followed, and it was not until the autumn that orders were freely placed, and although there are still many yards having little work to look forward to, the majority are fairly well employed. Three-fourths of the

whole tonnage of the world is built in British yards, and although the producing power is now too great to allow of all yards being fully employed, there are orders in the market which, when given out, will provide a considerable amount of further work. Buyers have now to pay an increased price to what they would have done three months since, owing to the rise in cost of material, but there has not been any advance in wages, and orders can still be placed at very low prices, probably not exceeding 10 per cent. of the lowest prices that have been accepted. Of the vessels built in 1886, 65 per cent. were built of steel, and last year the proportion will probably be nearer 80 per cent.; it is, indeed, becoming uncommon for a vessel to be built of any other material. At the commencement of last year steel plates, which had declined in price during the previous year, were £6 per ton: they are now fully £7 per ton, and much difficulty is experienced in getting deliveries from makers.

FREIGHTS.—MESSRS. ANGIER BROTHERS' REVIEW:—The past year opened with the prospect of realizing an early improvement in the general carrying trade after the three previous years of exhausting depression, but this anticipation was premature, and the general result of the first three quarters of the year, with but a few exceptions, was as low a range of prices as those experienced during either of the preceding years, and in several trades the lowest points on record were reached during this period. It was not till the autumn that the long-desired relief came, and from that date the movement commenced, but so difficult was it to realize and so sceptical were owners of the reality or solidity of the change that but slow and partial progress was made, each small advance was too eagerly secured, and further rise discounted by heavy forward engagements. Taking the various trades, Australia and New Zealand have been far from paying trades for steamers, though sailers have done well latterly. China and Japan have been a disappointing line—tea freights opened 5s. lower than in 1886, with long delays in loading both for Europe and America, and towards the close conference dissensions brought the rates down to 20s. to Europe. Regular sailings were kept up by the Canadian Pacific Railway Company between these ports and Vancouver, thus reducing the shipments *viâ* Suez Canal. The coasting trade in China waters was good for the first six months, leaving profit to a considerable fleet of steamers. The trade from the Philippines and Java has been poor all through at low rates. Burmah, Tonquin, and Siam employed a large amount of tonnage with but very little profit to the ships; the same applies to Calcutta and Madras Coast. From Bombay and Kurrachee fluctuations were greater, and during May, June, and July a good trade was done at fairly paying figures, but during the rest of the year this trade fell off and continued most unsatisfactory. The Persian Gulf took very little tonnage. In the Azoff, Black Sea, and Danube trades a large fleet of steamers was kept employed, though at very low rates for the first nine months, but during the last quarter this has been the largest and most profitable business that steamers have had for several years, stimulated by the unprecedently abundant grain crops in Russia. The well-maintained and wide demand for tonnage in this trade had its effect on the freights and pushed them up to good paying figures, at the same time lifting Mediterranean and Baltic rates proportionately. America and Canada have, with the exception of a short-lived spurt in cotton freights, been uniformly dull trades, and without anything like reasonable profit. The West Indies have given little or no employment beyond regular liners, except for sugars to the United States, and the trade has paid very poorly. The business with South America shows a large increase for the year, and some fair profit has been made in the River Plate and Brazils, though the heavy expenses and long delays make it far less profitable work than it should be. From the nitrate ports and west coast steamers have been more in use, and have done fairly well. The meat trade with the Falkland Islands and New Zealand has kept a few boats regularly employed. Outward freights remained poor for the greater part of the year till early autumn, when they hardened all round, reaching high figures for India, the Far East, and America. Part of the advance has been lost during the past month, but the demand continues fair, and the tone of the market is firm. The summary of the year is poor and unprofitable work for the first six months, but relieved by a solid progressive improvement during the second half, as far as regards the shorter trades. In the long trades there is less encouragement, the improvement being as yet but little felt. One important fact has been demonstrated—viz., that the present supply of tonnage is not too great for the demand, and that any increase in the general trade of the world at once lifts freights, but this favourable position is likely to be spoiled by the too eager haste of owners to increase their fleets.

TORPEDO-BOAT RUNS.

Extract from the log of some of the torpedo-boats, built by F. Schichau, of Elbing, in 1887, for the Italian Government, on the run between Pillau and Spezia.

I.—Voyage with the torpedo-boats Nos. 101 and 102. Left Pillau on the 15th June. Arrival in Portland, 18th June. Departure, 19th June. Arrival in Cadiz, 20th June. To Gibraltar, 4 hours. From Gibraltar to Spezia, 2 days 14 hours. Total time under steam, 8 days 22 hours.

II.—Voyage with torpedo-boats Nos. 103 and 104. Left Pillau 13th July. Arrival in Portland, 18th July. Départure, 19th July. Arrival in Gibraltar, 21st July. Thence to Spezia, 2 days 12 hours. Total time under steam, 8 days 8 hours.

III.—Voyage with torpedo-boats Nos. 105 and 106. Left Pillau 25th August. Arrival at Portsmouth, 28th August. Detained here 10 days by storm. Departure from Portsmouth, 7th September. Arrival in Gibraltar, 10th September. Departure, 11th, and arrival in Spezia on the 13th September. Total time under steam, 8 days 20 hours.

IV.—Voyage with torpedo-boats Nos. 107 and 108. Departure from Pillau 29th September. Arrival at Ramsgate, 2nd October. Arrival in Portland, 5th October, and left same day for Gibraltar, arriving on the 8th October. Arrival in Spezia, 15th October. Total time under steam, 8 days 22 hours.

Summary of the runs made by Schichau torpedo boats during the last two years:—

From Elbing, Skagen, &c.

25 to 30 boats to		Wilhelmshaven.
14	,,	Spezia.
5	,,	Constantinople.
3	,,	Nicolajew.
3	,,	Crondstadt.
3	,,	Pola.
1	,,	Foochow in China.

All these voyages were accomplished without any accident, and prove more than a volume could for the excellent sea-going qualities of the Schichau boats.

No other works in the world can look back on anything like a similar performance.—*The St. Petersburg Gazette.*

HOWARTH'S PATENT STRAINING-BOX FOR SHIPS' BILGES.

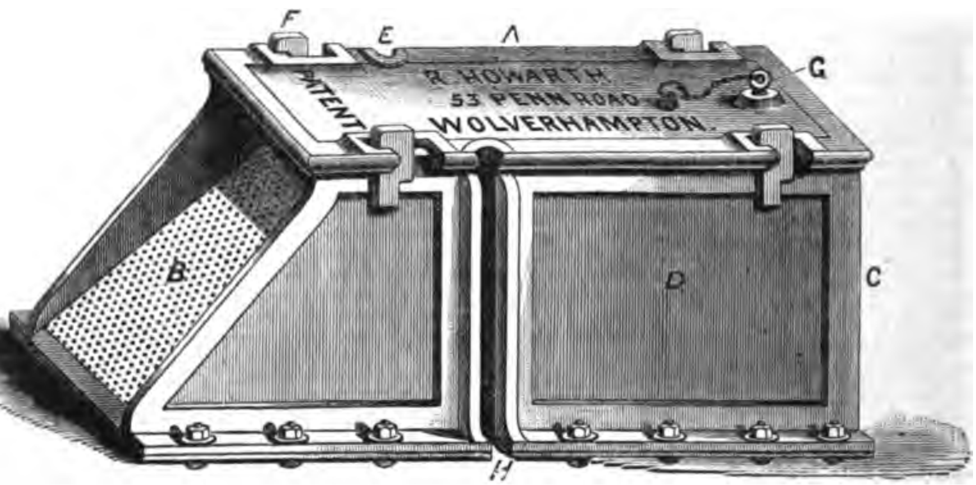
THE question of keeping bilges clean and dry is daily receiving additional attention, and not without reason. The presence of bilge water in sea-going vessels is to be detrimented upon several grounds. It lessens the deadweight carrying capacity of a steamer; it tends to engender disease; and when excessive, as in the case of choked pumps, is a material cause in the loss of a vessel, either by the mere weight of water overcoming the surplus buoyancy, or by the increased rolling of the vessel, due to the presence of loose water, destroying the vessel's stability.

Among the various arrangements essential for the "clearing" of the bilges, the effective working of the suction pipes is one of the most important, but hitherto the practical difficulties experienced in keeping bilge suction pipes clear have been formidable. Even in the most carefully conducted ship, substances other than water or oil sometimes find their way into the bilges, which, together with the mud deposited from ordinary bilge water, are frequent sources of trouble, if not removed before the pumps or the pump suction pipes are choked. Carelessness in the stokehold, or "a roll of extreme violence," causing "a fall of bunker coal across the stokehold at the moment that the bilge water by a mighty effort has swilled up the flooring boards and stokehold plates," may lead to the bilge suctions being entirely disabled, ordinary mud boxes, made of lead, in

such experiences, being practically useless. To obviate such difficulties, by removing all substances of any material size or weight from the bilge water on its passage to the strum-box, is the *raison d'être* of Howarth's Patent Straining-box for ships' bilges, which we illustrate on this page.

A brief description, with the assistance of our illustration, will place our readers in a position to judge of the value of this invention of Mr. R. Howarth, who, we understand, has had his share of experience as a sea-going engineer. For the sake of showing the Patent Straining-box in its entirety, it is not shown on the illustration placed in position, viz., in the frame space in the bilges, in which the bilge suction is situated, and in close contiguity to the latter. The inclined perforated plate, B, then looks towards the centre line of the vessel, and the patent straining-box is held in its position by means of a wedge arrangement in the slots or grooves, E and H.

It must be clearly understood that Howarth's Patent Straining-box is in no way intended to take the place of the ordinary strum-box protecting bilge suction. Mr. Howarth is rightly of opinion that additional precautions are necessary, if not in every vessel, certainly in the large majority of steamers having a *minimum* of time in port for cleaning bilges, &c., in order that the pumps may be kept clear, and the slight additional expense incurred by the adoption of his patent straining-box is not a matter of moment, when it is remembered that the temporary stoppage of a suction may result in serious damage to a valuable cargo. Most sea-going engineers are only too well aware of the difficulties experienced in clearing bilge suction pipes, fitted in the ordinary manner, after they have fouled. How often has the failure in the attempt to do so proved the proverbial "last straw," and the "good ship" sank to the bottom, alas! too often bearing with it still more valuable lives?



The plate, B, acts the part of a strainer, and as the vessel rolls the bilge water ascends it. Should any considerable *débris*, such as coals, waste, &c., be in the frame space, they are carried up the strainer, B, and enter the interior of the box by an aperture provided for the purpose at the top of B, while smaller bodies, *e.g.*, chips and oakum, are prevented from entering. Whether, however, the obstructive matter be large or small, it can easily be removed from either the interior of the patent straining-box, or from the surface of the inclined plane, B. In the former instance, it is only necessary to lift the cover, A.

The end of the straining-box near to the bilge suction is marked, C, on the illustration. It is similarly perforated to B, so that ere the bilge water reaches the suction, its comparative, if not absolute, freedom from *débris* of the smallest kind is ensured, and there is no danger of "choked pumps," nor yet of the efficiency of the pump being impaired by the character of the bilge water.

It is also important to note that there is no question of "inaccessibility" preventing the periodical, thorough, and effectual cleaning of the patent straining-box itself. Bulky substances, and indeed the major portion of any *débris* getting into the interior, can be readily removed at any time, but in addition, as no suction or other pipe leads into it, it can easily be taken out of its normal position, cleaned, and replaced.

NIGHT NAVIGATION OF THE SUEZ CANAL.

By FREDERICK WALKER.

SINCE the opening of the great maritime highway that has become an absolute necessity to the commerce of the Eastern Hemisphere, the increase in the traffic has brought about a series of serious disadvantages, the first and most important of which is the loss of time involved in performing an average passage through the Suez Canal. The distance from the entrance at Port Said to the anchorage in the Roads at Suez is but 87½ geographical miles, and the time occupied in the transit varies, of course, according to the number of ships that are passing in the opposite direction, averaging, however, 27 hours. In order to facilitate the passage of mail steamers through the Canal it was proposed to adopt a suitable electric light, so that the time hitherto wasted by lying in a siding from sunset to sunrise might be utilised to great advantage in continuing the journey during the night. The Peninsular and Oriental Steam Navigation Company were the first to make the experiment, and on the 22nd of March, 1886, the s.s. *Carthage* successfully exploited the scheme, to the satisfaction of M. Desavery, *chef du service*, M. Rumeau, *sous chef*, and several other officials of the Suez Canal Company. The apparatus used upon this occasion was a portable set devised and supplied by Messrs. Sautter, Lemmonier et Cie, of Paris, and was intended to be transferred from ship to ship when required.

The generator consisted of a 12 H.P. three-cylinder Brotherhood engine, connected directly to a compound wound Gramme dynamo, a flexible coupling allowing of any lateral strain incidental to temporary installations of this kind. The whole was enclosed upon a girder frame, and plated over so as to form an iron tank which efficiently protected the engine and dynamo from injury

during the uncertain process of embarking and debarking. It was found, however, that this casing impeded the necessary manipulation of the apparatus, so it was stripped off at the first available opportunity. Steam was supplied to the engine from the winch pipe, which was provided with a suitable T piece and blank flange, so that when the machine was placed in position on deck, certain lengths and bends of copper steam pipe, forming part of the portable gear, could be arranged to make a steam-tight connection. The exhaust was similarly conducted into the winch exhaust, communicating with the tanks or condenser, where such an arrangement was practicable, in other cases it was conducted overboard. The former method, from an economical point of view, was certainly preferable, although it possessed a disadvantage in the fact that a quantity of oil used to be carried away by the exhaust from the small high-speed engine.

On the other hand, when the exhaust was carried overboard, the clouds of partially condensed steam, in the somewhat humid atmosphere that prevails in the Canal at night, rising up in front of the bridge, was exceedingly objectionable to the pilot. The electrical leads, or conductors, were coiled upon drums, mounted horizontally within a box, upon the lid of which was arranged the necessary resistance coils and switches.

A small platform was fixed upon the stem of the vessel by two bolts, corresponding holes having been previously drilled through the stem for their reception. A Sautter-Lemmonier projector was fixed to this platform capable of furnishing a ray of light extending 1,350 yards ahead. The projector was provided with a hand lamp, having a complete focusing and hand-feed arrangement; a Mangin aplanatic mirror and dioptric dispersing lense, formed of vertical plano-cylindric elements, so as to afford sufficient lateral divergence of the rays. The projector barrel or lantern was about 15 in. in diameter, and mounted upon a swivel fork by suitable trunnions, so that the ray of light could be obliquely elevated or depressed, or turned so as to bear upon either side according to the wish of the pilot.

The auxiliary electric light apparatus comprised three automatic arc lamps, two being suspended forward one on either side about level with the deck, and one similarly suspended over the stern of the vessel. These were fitted each within a hood or lantern, which was designed by Mr. Hall, of the Peninsular and Oriental Company, for this purpose. A semi-elliptical aperture, with a metal reflector obliquely inclined, dispersed the rays of light around an area of about 50 yards radius, the light being thus shaded from the bridge, though fully illuminating passing dredgers, ships in sidings, &c. These lamps were switched on when required by the pilot, and also during the operation of changing the carbon pencils of the projector. This was invariably accomplished in three minutes, two hand lamps being provided so that one of them was always ready—fitted with fresh carbons—to put in the projector when necessary; the lamp taken out being allowed to cool before it was furnished with new carbons.

The output of the dynamo was 70 volts × 75 ampères, with a speed of 700 revolutions per minute, and as the four circuits were arranged in multiple, the division was to allow 45 ampères for the projector and 10 ampères for each automatic arc lamp, with the resistance coils interposed so as to balance the circuit.

The foregoing description serves to illustrate the pioneer electric lighting plant wherewith the night navigation of maritime canals was successfully demonstrated, and is retained by the Peninsular and Oriental Company for use on board of such of their vessels that are not fitted with an independent projector and auxiliary appliances on board. Other large Companies, notably the Messageries Maritimes, the Orient, and North German Lloyds, soon availed themselves of the facilities afforded by the adoption of the electric light, but it is obvious that the special advantage of a clear passage through the Canal at night is diminished in proportion to the number of vessels using the light on the same night.

The range of the beam of light from the projector is considerably shortened when the atmosphere is very humid. This does not appear anomalous when we consider that a comparatively thin film of vapour will obscure the sun, the primary source of light. Therefore, in foggy weather the electric light is of very little use, although in the Suez Canal such humidity is generally transient, and seldom hinders the vessel from proceeding on her way during the night, especially south of the Bitter Lakes.

In the "Noveau Règlement Provisoire," dated February 3rd, 1887, published by the Suez Canal Company, we find the rules laid down as follows:

"Steamers intending to go through the Canal at night must first satisfy the agents of the Company in Port Saïd or Port Tewfik, that they are provided:

"1st. *Forward*, with an electric projector throwing a light 1,200 mètres ahead; this projector must be placed as near as possible to the water line;"

"2nd. With an electric lamp and shade suspended above the upper deck, and powerful enough to light up a circular area of about 200 mètres diameter."

"The agents of the Company will decide whether the apparatus fulfils the requirements of the regulations, so that ships provided with them may without inconvenience be authorised to navigate the canal at night."

According, then, to clause 2, the three arc lamps before described are dispensed with, and a single automatic lamp substituted, suspended above and forward of the bridge, the switch being adjusted so as to be under the control of the pilot. In order to prevent as much as possible, an unsteady light from the transmission of vibration to the delicate mechanism of the lamp, spiral spring couplings are used to suspend the lamp, and also to connect the guys or stays.

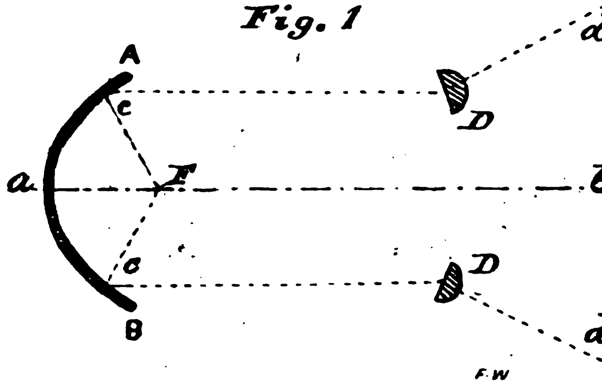
The electric arc is enclosed in a thick glass globe protected by wire netting, and a circular and slightly concave reflector about 3 ft. in diameter, gives the necessary divergence to the rays of light.

The projector, having a range of 1,200 mètres, remains essentially the same, but Messrs. Sautter and Lemmonier have introduced several improvements, such as increasing the heigh. of the barrel or lantern, so as to allow of the use of a longer positive carbon.

The management and manipulation of this electrical installation has become part of the manifold duties of a marine engineer, therefore a few remarks upon the projector may not be out of place in this article.

The diagram, Fig. 1, illustrates the functions of the mirror and divergence lense in an ordinary projector. A A represents the

Fig. 1



mirror, the surface of which is generated by the revolution of an arc of a parabola about its axis (of course when parabolic mirrors are used). The point, F, is the *focus* or the true position of the electric arc relative to the surface of the mirror. D D represents the elements of the dispersing or divergence lense, and the dotted lines indicate the direction of the rays of light emanating from the arc at F. Now, it is a well-known optical law that *the angle of incidence is equal to the angle of reflection*, or in other words a ray of light is thrown off a reflecting surface at the opposite angle to which it is received upon that surface. It is obvious, therefore, that any incident ray will make an angle with the normals to the curve equal to the angle of the axial line, *a*, *b*. Therefore, as an example, the incident ray, F, *c*, is reflected from the surface of the mirror in the direction, *c*, *d*, which is parallel to the axial line, *a*, *b*. In cases where a plain glass disc is substituted for the divergence lense D, a parallel beam of light would be projected, but as the width of such a beam would not sufficiently illuminate the buoys which mark the axe of the canal, a slight increase of divergence is necessary, which is regulated by the focal angle of the vertical elements forming the divergence lense. The arc is vertically "focused" by means of a rack and pinion at the base of the lamp, below the projector, which enables the operator to raise or depress the arc bodily, without disturbing it by moving the carbons individually. A horizontal screw and nut admits of the focal distance also being accurately adjusted. A small circular spot in the centre of the mirror is left unsilvered, and a corresponding disc of coloured or darkened glass is let into the back of the pro-

jector, so that the operator may align the arc from time to time. A photoscope, also attached to the projector, enables the state of the arc to be observed, as a reduced image of the carbon points is depicted upon the screen.

The arc itself is maintained by means of a right and left handed screw, fixed behind the guide bar, and moving the positive and negative carbon holders together. The upper carbon also may be adjusted by means of two worms and sectors, to any angle relatively to the lower or negative carbon. A concave screen is attached to the guide bar for the purpose of directing the rays of light upon the mirror, and the whole stalk of the lamp is arranged obliquely with respect to the axis of the mirror, so as to obtain a greater length of carbon and a correspondingly increased duration of time without necessitating a change of lamps. The upper, or positive carbon is consumed nearly twice as fast as the lower or negative, and if, in coupling up the electric leads, they have become reversed, the fact is at once apparent on striking the arc, for while the point of the positive (+) carbon forms a decided crater (see Fig. 2), the negative (—) becomes correspondingly

Fig 2

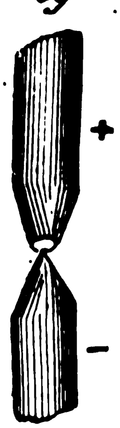


Fig 3

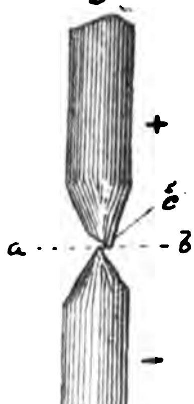
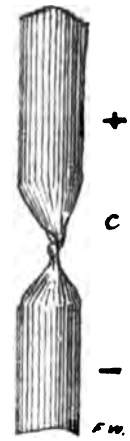


Fig 4



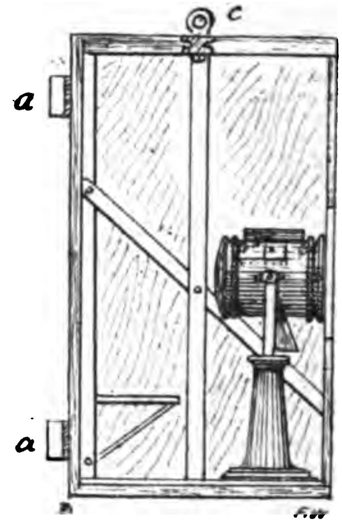
pointed. The best arc is obtained when the crater is slightly oblique, as shown by Fig. 3, where the line, *a*, *b*, represents the axis of the mirror, the latter being situated at *a*, and the concave screen above referred to, at *b*. The crater, however, should not be allowed to deviate too much from the centre of the carbon, but should be laterally adjusted so that the lip, *c*, of the crater is but slightly depressed below the arc. The negative (—) carbon has a tendency to become bulbous, Fig. 4, a state which eventually entails the rupture of the arc, and momentary cessation of light. In the Suez Canal, from El Ferdane to Lake Timsah (kilomètres 60 to 75) there are some awkward curves, and across Lake Timsah the course is defined by buoys forming the arc of a circle. It is well, therefore, to be so prepared that there will be an uninterrupted beam of light until the ship has again entered the narrow way. Any necessary intermission now must be of short duration, for the axe of the canal is not straight until the vessel has reached Tussoum (85 kilomètres). If possible, the carbons should be made to last until the ship has passed the North Light (100 kilomètres) and entered the Bitter Lakes, when there will be ample time and opportunity to change the lamps, as the light is seldom required while crossing this lake. After the South Light (112 kilomètres) is passed, the projector will again be in requisition, and a good and a steady light maintained until past Chalouf (140 kilomètres). However, under ordinary circumstances, a positive carbon should last from the South Light until the ship has entered the Roads at Suez (165 kilomètres).

The electro-plated carbons last much longer than bare ones of equal sectional area; the metal generally used being copper. Although nickel is much superior, it is too costly in practice. A tolerably soft, homogeneous carbon, about 20 millimètres diameter, will work well with the projectors used on the canal, great care being taken to ensure good and clean contact in the holders.

Several attempts have been made to render the working of projectors perfectly automatic, but, however successfully this may be accomplished from an electrical point of view, the exigencies of night navigation in the Suez Canal will demand the constant attention of an operator, although, if the feed of the carbons and the focusing were automatic, a skilled man would not be required to stand by the whole time.

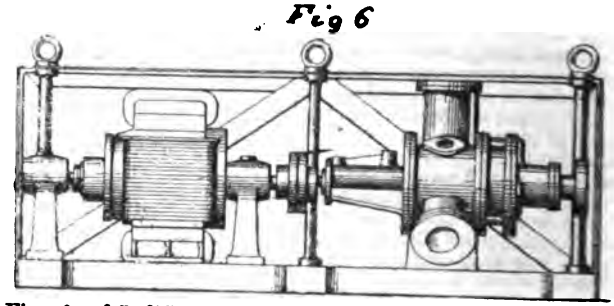
When vessels are fitted with a permanent installation of this kind, the provision for electrically lighting the ship throughout consists of two dynamo machines, and two separate engines for driving them, these being fitted up in the engine-room. While passing through the canal, one of the machines is disconnected from the ship circuit, and coupled up to the projector and suspended lamp. This circuit may be made by properly covered leads, with suitable terminal boxes for attaching the short lengths of cable that are required to conduct the current to the lamps. The projector may be enclosed in a box or case (see Fig. 5), in which the operator may sit. Two forks, *a a*, are attached to the

Fig 5



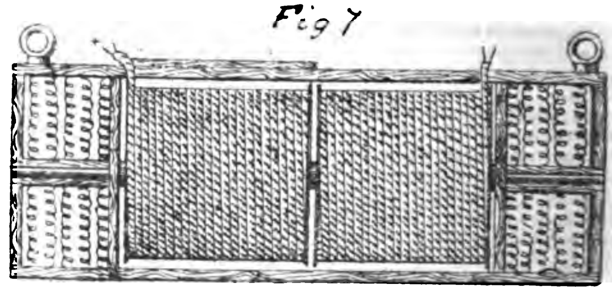
back of the case so as to guide it down the stem to the proper height above the water line, it being suspended from a davit, or other suitable contrivance by means of the eye-bolt, *c*. The portable installation supplied by Messrs. Sautter and Lemmonier,

Fig 6



Figs. 6 and 7, differ very little from the pioneer apparatus before described, with the exception that the cable box (Fig. 7) is more

Fig 7



compact, having fewer drums or reels, and the dynamo is one of the type known as "Duplex," made by that firm. The projector and box are the same as shown by Fig. 5, the whole apparatus weighing about 2½ tons.

The dynamo and engine might be rendered still more compact if a Tower spherical engine was used as a motor, as these engines occupy very little space in comparison with the power developed on the shaft, and in my opinion would be suitable for the duty upon the canal, as the whole of the working parts are well enclosed.

Messrs. Stephens & Smith, of Millwall, are also bringing out a special apparatus for use in the Suez Canal and other narrow waterways, which, though being thoroughly efficient for the purpose, is very compact and durable.

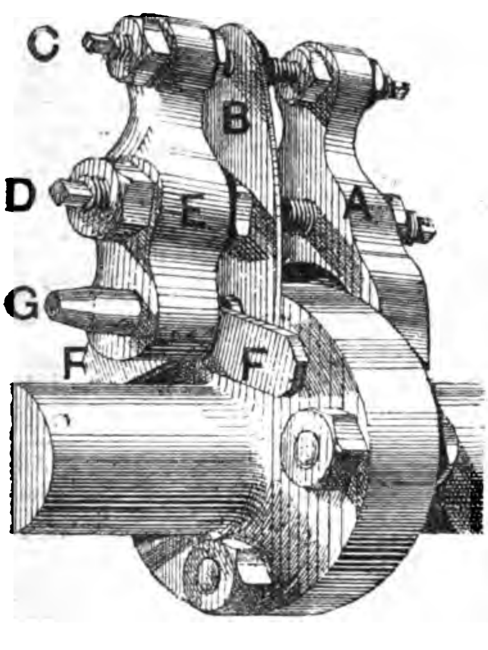
It is evident that, in point of economy, there exists great advantages to shipowners in general by this application of the electric light, reducing as it does, the time occupied in the transit by 10 or 11 hours, under ordinary circumstances, and, as all who are interested in matters maritime and commercial, are looking hopefully forward to an increase of trade, the adoption of the electric light to facilitate navigation by night is likely to become general, not only upon the Suez Canal, but upon other projected ship canals that are yet in the future to be important highways of commerce.

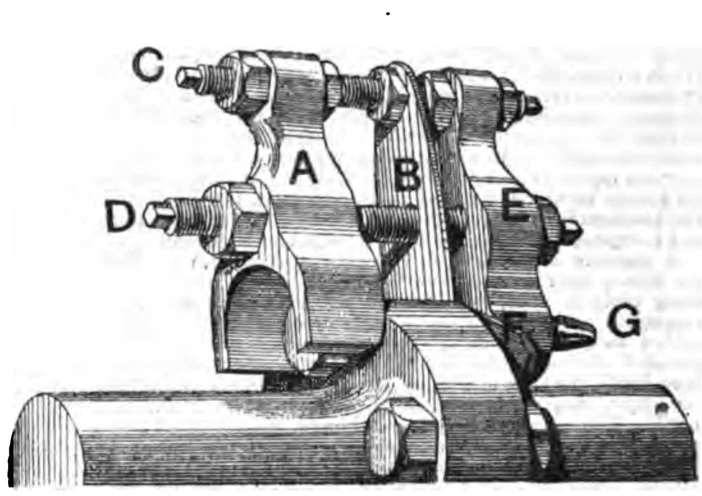
THE INVINCIBLE COUPLING BOLT EXTRACTOR.

A NEW and important contrivance has lately been introduced into the market for extracting coupling bolts from the shafting of steam ships. Hitherto this has been a source of great expense and trouble when the shafting has to be disconnected and again replaced in a limited amount of time, and in a confined space, as the funnel of a steam ship. The principle, as far as we are aware, is decidedly novel and original as well. By means of this simple contrivance, the most difficult coupling bolt can be taken out, or cranks or couplings taken off. The "Extractor" has often been used successfully when other means have failed, even in cases where there was plenty of room, and where a good solid blow could be given with a heavy hammer. It is particularly adapted to places where a blow cannot be given, as for instance near bulkheads, crank webs, or bearings in marine work, and in the case of overhead couplings or shore repairs. By its use the annoying delay while in dry docks (in the case of steamers) through even one or two stubborn coupling bolts, can be avoided, and thus the cost of the machine can be covered in a very short time.

In the case of mill or workshop shafting, the shaft need not be taken down, but could be sprung to one side, so as to allow the wedges to bear on the end; by this means the coupling can be drawn off, and no fire be required, which will be an advantage apparent to every one who has to do with belt shafting. Another advantage, and a very considerable one, lies in the fact that skilled labour is not necessary in the use of the tool. On board the s.s. *Limburg* the "Extractor" was used for the purpose of taking out the coupling bolts of the crank shaft. The ship's engineers and firemen were all Dutchmen, they had never seen the tool before, and although the engines had to be turned by hand to bring each bolt into the proper position to apply the drives, the whole of the fourteen bolts were drawn out in five hours. Not a single bolt was damaged, although they were set very fast, and the space in which the men worked was very confined. The "Extractor" is now being largely used, and the sales will no doubt be extensive as its merits become better known. Messrs. Kellar & Allen, Exchange Buildings, Mount Stuart, Cardiff, are the patentees and manufacturers. The following is a sketch of the "Extractor," and the method of fixing and using the same.

The jaw, A, is placed over the head of the bolt to be driven out, or behind the coupling, as the case may be, when the plate, B, is placed on the opposite side of the coupling. A and B are held in position by the two bolts marked C and D; the second jaw, E, is then put in position, and kept back about 1 in. from the point of the bolt to be drawn out, the wedges, F F, are then inserted, and the nuts on C and D screwed up, and the wedges driven home. Should the bolt not start with this, a blow can be given on the loose pin, G, which, with the pressure already exerted, will certainly start any bolt, no matter how firmly set. The jaws are of crucible cast steel, the screws and wedges being made of mild hammered steel.





LAUNCH OF THE S.S. "KULING."

On December 5th, the pioneer steamer of the Upper Yangtze Steam Navigation Company, which is intended to be the first steamer to tempt the rapids of the Yangtze above Ichang, was launched from Messrs. Boyd & Co.'s yard, Pootung. The weather was perfect, and autumn weather in Shanghai when it is good is the best in the world; a perfectly unclouded sky and a light air from the westward, hardly enough to blow out the British ensign, and the Company's houseflag—blue and white with the character "shang" (上) "excelsior" on a red diamond—that floated from the stern and bow respectively of the new steamer. There was a large gathering of ladies and gentlemen to see the launch, and the steamer was examined with the greatest interest as she lay on the cradle, waiting for the tide to rise high enough for the signal to be given. She has been specially designed for navigating rapids and dangerous rocky channels, and her design contains several novel features, the result of which will be watched with great interest by those who make naval architecture a study.

The designer of the *Kuling* is the well-known naval architect, Mr. Josiah McGregor, recently of Calcutta and now of 78, Queen Victoria Street, London. Mr. McGregor having successfully designed, both for the Indian Government and for private firms, a large number of light draft steamers now navigating the Ganges and Brahmaputra rivers, has made a special study of this class of boat, and the present steamer is the latest outcome of his inventive genius. Combining, as she does, the experience gained in the construction and design of sternwheel boats in the United States, with the most recent devices for the adaptation of mild steel to the hull and to the machinery introduced recently in Great Britain, this boat unites the advantages of both systems. By placing the engines and boilers amidships (an innovation never before attempted in a sternwheeler), the boat remains always in trim, and the excessive strains caused by placing the boiler and engines at the two extremities of the vessel are avoided. At the same time a clear 'tween-decks unobstructed is gained; nothing beyond the funnel casing obstructing the clean sweep of the spacious deck,—the forced draft employed necessitating an enclosed stokehold, the usual large space over the engine-room and boilers is non-existent. The power is conveyed to the wheels by means of two piston-rods 55 ft. long, carried on guides under the main deck. She has a balanced rudder aft of the wheels supported on a central air-hold running between them. This heavy rudder is managed by powerful steam steering gear. Her dimensions are:—Length, 176 ft.; beam, 28 ft.; and depth, 7½ ft.; and she will be driven by two sets of compound engines, with cylinders of 18 and 30 in. diameter respectively, and 5 ft. stroke. They are intended to be worked with a pressure of 150 lbs. of steam, supplied by two locomotive boilers. Her net tonnage is about 250 tons and her carrying capacity about 500 tons, and she has also accommodation for a large number of Chinese passengers and a few Europeans. She has been built to be of as light a draft of water as possible, and is expected to draw only 27 in. light, and 4 ft. loaded.

A platform had been erected at the steamer's head, and from her bow, a contrast to the two Wasteneys Smith's anchors that hung ready to bring her up when she reached the water, was suspended by a blue ribbon a bottle of champagne, decorated with a bouquet of flowers. It was after half-past three when Mr. P. V. Grant, the head of the firm of Boyd & Co., escorted Miss Little, the niece of Mr. Archibald J. Little, the manager of the Upper Yangtze Company, to the platform and handed her the bottle. The last shores were knocked away, and the vessel began to glide gracefully into the Whangpu as Miss Little dashed the bottle against the bows, with the words, "Success to the *Kuling*!" Smoothly, and without a hitch of any kind, amid the cheers of the spectators, the *Kuling* took the water.

Messrs. Bow McLachlan & Co, of Paisley, are the builders of the hull and engines of the *Kuling*; and that her name is the ancient title of the city of Kweichow, the largest inland Customs' Station in China. The name is appropriate, as it is hoped that the new steamer and her consorts will do away to a great extent with the *raison d'être* of Kweichow. The name may also be translated, "firm as the mountains."

New Eight-Gun Sloop.—A new swift eight-gun sloop is to be commenced at Sheerness Dockyard as soon as the *Daphne* is launched. The new vessel will be of 1,040 tons displacement, and will be fitted with machinery of 2,000 I.H.P.

CLYDE STEAM AND SAILING SHIP ASSOCIATIONS.

LECTURE BY MR. ROBERT DUNCAN.

The second of a series of addresses to members of the Clyde Steam and Sailing Ship Associations was delivered in the hall of the Philosophical Society, Glasgow, by Mr. Robert Duncan on the subject of the "Classification of Shipping." There was a large attendance. Mr. Nathaniel Dunlop presided.

The Chairman, in introducing the proceedings, remarked that good had resulted all round from the calumnies that had been cast upon the shipping interest and the inquiries that had been made. Evils had been held up to be guarded against, and the good which was found to predominate had been set forth. They must see that the ships they built and owned were the best that could be constructed, and that their aims and methods were worthy of the position they occupied in the nation's commerce.

Mr. Duncan, after tracing the early history of Lloyd's Registry, and referring to its amalgamation in 1885 with the Liverpool Registry, proceeded to allude to its great position. An estimate of this, he remarked, may be formed from the statistics in Lloyd's Universal Register for this year. From the returns of the 10 principal classification societies of the world, Lloyd's included—all of which have come into existence since Lloyd's Register began its great career—it appears that these 10 register societies have among them about 20 million tons of shipping, and of this amount Lloyd's proportion is 8½ millions; Bureau Veritas comes next with 4½ millions. The Netherlands Register, Norwegian Veritas, and American Record follow in the order named with about 1½ millions each. German Lloyd's is sixth with about 900 thousand tons. The Italian Register, the Austro-Hungarian Veritas, the Register Maritime, and the Greek Veritas divide about one million tons between them, the last having only 60 thousand tons. Another point of importance is the proportion of wood and iron tonnage in the respective books. 93½ per cent. of all the tonnage in Lloyd's Register is of iron or steel, the remainder being wood or composite, the latter a very small amount. The extent to which wooden shipbuilding and shipowning still prevail in foreign countries will be evident from the following statement:—While only 6½ per cent. of all Lloyd's classed tonnage is of wood, 41 per cent. of the tonnage of the Netherlands Register is of the same material. The wooden tonnage of Bureau Veritas is 67 per cent.; of the Italian Register, 73 per cent.; of the German Lloyd's, 77 per cent.; of the Register Maritime, 78½ per cent.; of the American Record, 81 per cent.; of the Austrian Veritas, 92 per cent.; of the Norwegian Veritas, 92½ per cent.; of the Greek Veritas, 100 per cent.; the latter not having a composite, iron, or steel vessel in its books. From Lloyd's Register Book for this year we learn that only 2,384 tons of wooden vessels were built to class by Lloyd's in 1886; which shows the almost entire cessation of wooden shipbuilding under Lloyd's Registry both at home and abroad. From the same volume we learn that the tonnage of iron and steel vessels bearing Lloyd's class is as follows:—

	Tons.
British	6,519,644
Colonial	164,777
Foreign	1,290,421
Total iron and steel	7,974,842

Of wood and composite vessels classed by Lloyd's, the tonnage is as under:—

	Tons.
British	382,492
Colonial	82,592
Foreign	83,141
Total wood and composite	548,225

The aggregate of all kinds classed at Lloyd's is:—

	Tons.
British	6,902,136
Colonial	247,369
Foreign	1,373,562
Grand total	8,523,067

It is stated in the Universal Register that the total tonnage of the world is 20,943,650, and of this the United Kingdom and Colonies possess 10,539,166. Rather more than half of the tonnage of the world flies the British flag; and it will be seen at a

glance how large a proportion of this purely British tonnage bears the distinctive marks of Lloyd's Register.

Dealing next with the objects and methods of classification of shipping, and passing on to speak of the basis of Lloyd's rules for construction, Mr. Duncan pointed out that:—

As the scantlings are apportioned to the heaviest strains that can be brought to bear on vessels of the fullest forms, designed to the upper limits of the respective grades, the strength requirements of the rules become oppressive on all the finer forms in various ways. Firstly, by being burdened with a weight and strength of scantlings sufficient for double or treble their load displacement. Secondly, by the consequent greater first cost of the vessel itself and the power required to drive it. Thirdly, in that the extra weight where the draught of water is limited necessitates greater length and breadth, and consequently increased scantlings, with still greater weight, displacement, and power than would be required were the scantlings equitably proportioned to their work. The action and reaction of these excesses continually add to the size and cost, without in any respect adding to the efficiency of the vessel, or of the service for which it may be required. The remedy for this is simple, and involves no change of principle in Lloyd's rules. "Let the dimensions and load line displacement together determine the form, strength, and scantlings for the work required."

Mr. Duncan then took up the second point in what he called his "Reform Bill," maintaining it to be desirable, in the interest of the shipowners and shipbuilders of Britain, that there should be a revision of the constitution of Lloyd's Registry Society and in the representation of the principal shipowning and shipbuilding ports upon the Council. He said:—

At present shipbuilders are not recognised by the constitution as having either rights, privileges, or interests in the affairs of the society, or in their own business. Possibly this may have been due to the fact that at the time of the framing of the constitution the shipbuilders were entirely independent of the registry, and acknowledged as such, by the London underwriters, merchants, and shipowners, who then reorganised it. It need hardly be said that the subsequent assumption by Lloyd's Register Committee of the entire control of the shipbuilding of the country has totally altered the conditions of the respective interests represented and affected by it. Shipbuilders from being independent have become the humble servants of the society, with a very small voice in the construction of the vessels they build. I doubt if the underwriters, merchants, and shipowners, who framed the constitution, foresaw or intended this result; or if any of them at the present day would be disposed to attempt a justification of this unrepresented exclusion of the great interest they so entirely control.

Mr. Duncan then submitted a table he had drawn up as the result of an analysis of Lloyd's Register Book for the present year. Omitting some of the details the table is as follows:—

TOTAL BRITISH TONNAGE CLASSED IN LLOYD'S REGISTER BOOK 1887-1888.
6,566 Vessels of 6,902,136 tons.

Vessels belonging to.	Percentage of Total British Classed Tonnage.	Present Representation on Lloyd's Committee of Fifty.	Proportion of Representation to Tonnage Classed.
London	24·33	26	12·17
	22·24	8 } 21	11·12
Liverpool	Branch Committee	13 } 21	
Tyne			10·17
Wear	20·35	7	
Tees			
Glasgow to Greenock ..	15·32	5	7·91
Aberdeen ..			2·36
Dundee.. ..	4·72	1	
Leith			
Cardiff			2·40
Newport.. ..	4·31	1	
Swansea			1·68
Hull	3·37	1	
Bristol	·56	1	
Total	95·20	50	41·09
Scotland's Tonnage and Representation ..	20·54	Is 6	Should be 10·27

In his concluding remarks Mr. Duncan referred to Scotland's right to additional representation on Lloyd's Committee:—

In addition to the shipowning interest of Scotland, the Clyde has a special claim to representation as the greatest shipbuilding centre in the world. According to Lloyd's Register, 399,711 tons of shipping were built in the United Kingdom last year, of which Lloyd's classed 371,908 tons. For the details of this shipbuilding, we have to apply to the statistics of the Board of Trade for 1886, and under the heading of "Total number and net tonnage of sailing vessels, and gross tonnage of steam vessels, built at each port in the United Kingdom in 1886, exclusive of vessels built for foreigners and war vessels," we find that—

			Tons.
London built	45	vessels	3,636
Liverpool ,,	16	,,	18,268
The Tyne ,,	50	,,	49,614
The Wear ,,	28	,,	46,187
The Tees ,,	18	,,	33,797
Total......	157		151,502

While the Clyde between Glasgow and Greenock built 151 vessels, of 135,159 tons. Please note that the five shipbuilding districts of England above enumerated return 41 members to Lloyd's Register Committee of 50, Liverpool having in addition, as already stated, a branch committee of 13 members. This makes a total representation of 54 members for these ports on and directly influencing the administration of Lloyd's Register Committee, while the Clyde has only 6. The Clyde, which owns one-sixth of the total British tonnage classed in Lloyd's Register, and which build six times the British merchant tonnage of London and Liverpool combined, has about one-seventh of their joint representation on Lloyd's Register Committee, and less than one-ninth of the combined London and Liverpool Committees of Lloyd's Register. It need scarcely be said that there is matter here for serious reflection on the part of the shipowners and shipbuilders of Scotland, and I might add, also for our friends of the Tyne, Wear, and Tees. They equal the Scottish ports in the tonnage owned among them, and in their aggregate shipbuilding. Between them and us we build nearly all the shipping of Great Britain and of the colonies and foreign countries who favour British shipbuilding. Between them and us we own 40 per cent. of all the tonnage classed in Lloyd's Register Book, yet as shipbuilders we have not a voice in its construction, and as shipowners, merchants, and underwriters, not the fourth part of its representation on the Committee of Lloyd's Register. For Scotland the case is peculiar; much of our shipbuilding comes from England, as well as from the colonies and foreign countries, and not a little of it from our compatriots resident in England and abroad, for whose shipowning enterprise England naturally gets credit. In respect of shipbuilding London and Liverpool are nowhere in comparison with Scotland, and in shipowning we are not far short of either. Is it not time, therefore, that the north country shipowners and shipbuilders should respectfully invite Lloyd's Register Committee to consider a revision of their constitution and representation? Possibly it might be said on behalf of Scotland that a branch committee on the lines of Liverpool would suit us better than additional representation in London. The honour of a seat at the London Board is counterbalanced by the inability of our representatives to attend the weekly meetings of the committee, or indeed oftener than once a month or three or four times in a year. In this way much of the value of their services is lost to their constituents while all their time and collective wisdom would be utilized on a local committee with properly delegated powers. It is for you, gentlemen, as the representative shipowners of Scotland, in conjunction with the shipowners of the north of England, to take the necessary action to have your representation rectified; and I think I may venture to add on behalf of the shipbuilders and engineers of Scotland and the north of England, and on behalf of the three great institutions I have named as representing the science and art of naval architecture and marine engineering in Great Britain, that you may count upon their hearty co-operation, as they would earnestly solicit yours to amend your representation and to remove from the constitution of Lloyd's Register the slur that presently rests on the unrepresented heads of the greatest shipbuilding and engineering interests of the world.

The Chairman, in inviting discussion on the paper, remarked that it seemed to him that Lloyd's and the Board of Trade should be more completely part of themselves, and that these institutions should be flexible and ready to adapt themselves to the needs and the progress of the times. There was clearly a demand for a greater representation of the shipbuilding and shipowning interests of this district.

Mr. Martell, chief surveyor of Lloyd's, said it was difficult for him to understand Mr. Duncan's statement that shipowners had no control over the manner in which Lloyd's Register Committee conducted their business, seeing that that committee contained a very large number of representative shipowners. When Mr. Duncan took credit to the Glasgow shipowners for first forming the rules of Lloyd's Register, it occurred to him how frequently Mr. Samuda at the meetings of the Institution of Naval Architects, always took credit to himself as being the man who first formed these rules.

Mr. Duncan said that the words he used were a quotation from the annals of Lloyd's Register.

Mr. Martell said that that being so he would not say more on the subject. With reference to the alteration of the basis of tonnage, they were impelled to make it by the shipowners throughout the country. It was an alteration entirely in the interests of shipowners and shipbuilders, and it gave a very large amount of satisfaction. In conducting a great institution such as Lloyd's, they had to look at the general desire in making alterations of that sort. In regard to scantlings, they did not hear generally throughout the country that such an alteration was desired. He had formerly expressed an opinion on the subject, and he must say that with all Mr. Duncan's eloquence and his research and his practical skill, he had not induced him to alter that opinion. If they were to substitute a basis of displacement for scantlings for the basis they had at present, they should find more anomalies than they had at the present time. To alter the present basis without good and sufficient reason would, in his opinion, be a very serious leap in the dark. (Applause.)

A vote of thanks to Mr. Duncan for his paper was afterwards passed, and the meeting was brought to a close.

STEAM-WHISTLE SIGNALS ON THE THAMES.

(From the *London Gazette*.)

At the Court at Osborne House, Isle of Wight, the 29th day of December, 1887. Present, the Queen's Most Excellent Majesty in Council.

Whereas by "The Thames Conservancy Act, 1857," it is enacted that the Conservators of the River Thames shall have power and authority, from time to time, to make bye-laws for the regulation, management, and improvement of the River Thames and the navigation thereof, in the manner thereby provided, and to impose penalties, not exceeding £5, for the breach or non-performance of such bye-laws:

And whereas by the 31st section of "The Thames Conservancy Act, 1864," it is enacted that bye-laws made under the authority of either of the said recited Acts shall not have any force unless and until they are allowed by Order of her Majesty in Council:

And whereas the said Conservators have, in exercise of the powers conferred upon them by the said recited Acts, made and submitted for the allowance of her Majesty in Council certain rules and bye-laws for the regulation, management, and improvement of the navigation of the River Thames, and amongst others certain bye-laws which have been allowed by Order in Council dated the 18th day of March, 1880:

And whereas it has been deemed expedient by the said Conservators to repeal in part the said last-mentioned bye-laws, and to make new bye-laws in lieu of the portions so repealed in the manner set forth in the schedule hereunto annexed:

And whereas the said new bye-laws have been duly published in accordance with the said recited Acts, and it has been made to appear to her Majesty that the said new bye-laws are reasonable and proper:

Now, therefore, her Majesty, by virtue of the power vested in her by "The Thames Conservancy Act, 1864," and of every other power enabling her in that behalf, by and with the advice of her Privy Council, is pleased to allow the said bye-laws.

C. L. Peel.

Schedule referred to in the above Order.

Bye-laws for the amendment of the bye-laws for the regulation, management and improvement of the navigation of the River Thames, allowed by the Queen's Most Excellent Majesty in Council on the 18th day of March, 1880.

The Conservators of the River Thames in exercise of the power and authority vested in them by the Thames Acts, 1857 to 1883, and of every other authority them thereunto in anywise enabling, do order and direct as follows, that is to say:—

From and after the day when these bye-laws shall be allowed by the Queen's Most Excellent Majesty in Council, bye-laws 17, 18 and 19 of the bye-laws for the regulation, management and improvement of the navigation of the River Thames allowed by her Majesty in Council on the 18th day of March, 1880, including the words "steam-whistle signals," immediately preceding such bye-law 17 shall be, and the same are, hereby repealed; and the said bye-laws of the 18th day of March, 1880, shall have effect, and be construed as if the following bye-laws had been inserted therein in lieu of such repealed bye-laws, and the following bye-laws shall have effect and be construed accordingly, and shall be taken to have been numbered as the same are hereafter numbered, and the words, "Bye-laws and Rules Regulating the Navigation of the River between Yantlet Creek and a line drawn from Blackwall Point to Bow Creek," in the said bye-laws of March 18, 1880, shall be thereafter read as if the same immediately preceded the words "steering and sailing rules" leading to bye-law 40, and the following bye-laws shall apply to the river Thames from Yantlet Creek to Teddington.

STEAM-WHISTLE SIGNALS.

17. When two steam vessels are in sight of one another, and are approaching with risk of collision, the following steam signals shall be intimations of the course they intend to take.

(*a*.) One short blast of the steam-whistle of about three seconds' duration to mean "I am directing my course to starboard, and intend to pass you port side to port side." The use of this signal shall be optional.

(*b*.) Two short blasts of the steam-whistle each of about three seconds' duration, to mean "I am directing my course to port and intend to pass you starboard side to starboard side." The latter signal shall not be used in the case provided by Rule 22 where that rule can be obeyed; but it shall be compulsory to use this signal when a departure from that rule is necessary to avoid immediate danger.

(*c*.) Three short blasts of a steam-whistle, each of about three seconds' duration, shall mean "I am reversing my engines."

18. When a steam vessel is turning round or for any reason is not under command and cannot get out of the way of an approaching vessel, or when it is unsafe or impracticable for a steam vessel to keep out of the way of a sailing vessel, she shall signify the same by four or more blasts of the steam-whistle in rapid succession, the blasts to be of about three seconds' duration.

19. The signals by whistle mentioned in the preceding rules shall not be used on any occasion or for any purpose except those mentioned in the rules; and no other signal by whistle shall be made by any steam vessel unless it be by a prolonged blast of not less than five seconds' duration.

19*a*. Vessels coming out of dock shall signify the same by a prolonged blast of the steam-whistle of not less than five seconds' duration, and in cases where a vessel is not under steam the tug boat in attendance shall make the same signal and no other steam-whistle signal shall be made by vessels coming out of dock.

The Nyassa Steam Canoe.—A new departure in shipbuilding as regards small craft is presented by the *Nyassa* steam canoe, a pretty little boat which has been built for the Universities African Mission Society, by Messrs Simpson & Strickland, of Dartmouth, to the order of Mr. S. H. Terry, consulting engineer to the society. The *Nyassa*, which is intended for service on the lake of that name, is constructed entirely of delta metal, and for convenience of transport she has been built in three sections. She is 21 ft. long, with a beam of 7 ft. and a depth of 3 ft., and draws 16 in. of water with her engine and boiler on board. The fore and aft compartments are provided with airtight bulkheads, and a triangular centreboard is carried in a casing in the forward part of the middle compartment. There is an opening in her deck amidships 9 ft. 6 in. in length by 4 ft. wide, fitted with a covering 6 in. high, with a delta and teak gunwale. There are no bulwarks, but the metal deck is covered with teak. She carries two masts, the mainmast having a copper lightning conductor. Under steam she is driven by a three-bladed screw propeller. She is fitted with a jury rudder-post, between which and the stern-post her screw propeller is placed. When required for sailing only, the propeller and shaft can be removed with the rudder-post, and the rudder can be attached directly to the stern-post. The *Nyassa* was recently tried at Dartmouth with seven persons on board. With steam at 100 lbs. pressure she made seven miles an hour, and with her sails and wind abeam six miles an hour, dragging her screw, the boat proving very handy. The boiler furnace is adapted for burning wood and other similar fuel found in tropical countries.

LIST OF VESSELS LAUNCHED IN 1887.

(*Continued from page* 347.)

GERMAN.

By the Actien Gesellschaft "Wiser," Bremen.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. I.
† Wacht	Steel	Steam	Foreign	1,500	4,000
* No. 87	"	"	"	280	80
* No. 88	"	"	"	280	80
* B. No. 28	Iron	Drdgr	"	240	70
* B. No. 29	"	"	"	540	200
* B. No. 30	"	"	"	540	200
S. No. 261	"	Pontn.	"	156	—
S. Nos. 262—273 ..	"	Barge.	"	1,200	—

Vessels Built During the Year 1887: F. Schichau, Elbing, Prussia.—Nineteen first-class torpedo boats of about 85 tons displacement, two torpedo division boats of about 260 tons displacement, one torpedo hunter of about 450 tons displacement, seven passenger paddle steamers, two screw steamers, two steam dredging machines, one large floating dock.

SWEDISH.

By Motala Mekaniska Werkstad s, A.B. Motala.

Name of Vessel.	Built of	Class.	Owners.	G.T. Regis.	H.P. N.
* Najaden	Steel	Steam	Foreign	457	120
* Michael Archangel	"	"	"	361	100
* Serjåschå	"	"	"	482	70
* Bacu	"	"	"	482	70

* Compound. † Triple.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from December 23rd, 1887, to January 24th, 1888.

Agnew, Thomas, engineer to the *Rapid*, to date December 28.
Allen, Alfred J., staff engineer to the *Boadicea*, to date December 29.
Bromley, Wm., chief engineer to the *Reindeer*, to date January 8, re-appointed on promotion.
Burner, Wm. H., chief engineer to the *Vernon*, additional to date December 28.
Cartmel, Danl., fleet engineer to the *Volcano*, to date January 23.
Cook, Wm., chief engineer to the *Garnet*, re-appointed on promotion, to date December 2.
Collings, Albert C., assistant engineer to the *Curacoa*, to date December 28.
Drake, Sidney J., assistant engineer to the *Boadicea*, to date December 29.
Edwards, W. F., assistant engineer to the *President*, additional to date January 5.
Gale, Wm. C., fleet engineer to the *Cleopatra*, additional to date January 16.
Hamm, Richd. S., chief engineer to the *Carysfort*, to date January 10, re-appointed on promotion.
Johnson, Henry G., chief engineer to the *Camperdown*, to date December 28.
Mitchell, Fredk., engineer to the *Boadicea*, to date December 29.
Mitchell, John L., engineer to the *Stork*, to date December 28.
Parsons, Geo., engineer to the *Champion*, additional to date January 16.
Perkins, Geo. L. R., assistant engineer to the *Pembroke*, additional to date January 16.
Robins, Saml. J., chief engineer to the *Mercury*, to date December 29.
Simmonds, Robt. W., assistant engineer to the *Boadicea*, to date December 29.
Ward, John T. H., assistant engineer to the *Severn*, to date January 21.
Wheatley, Geo. E., assistant engineer to the *Porpoise*, to date December 24.
Wright, Wallace, assistant engineer to the *Serapis*, to date January 5.

SOUTH WALES TRADE NOTES.

Cardiff.—The result of the past year's work as regards th foreign exports of coal, coke, iron and steel are very satisfactory so far as the Welsh ports are concerned, for whilst at most of the northern ports there has been a falling off in the quantity of steam coal exported, Cardiff, as far as this commodity is concerned, shows an increase of 833,514 tons; Newport, an increase of 375,410 tons; and Swansea, an increase of 12,976 tons. As regards the present condition of the staple trade of this district, it is not too much to say that, all round, things present a very cheering aspect, and that there is every prospect of a prosperous year. During the past four weeks, notwithstanding the intervening Christmas holidays, and the dense and prolonged fogs which have for something like a fortnight been experienced in the Bristol Channel, the weekly shipments have been quite up to the average of the past year, and there can be very little doubt that, but for the drawbacks indicated, the exports of coal, both steam and house, would have been the largest on record. Steam coal.—During the month the demand for steam coal of all descriptions has shown no signs of abatement, and, as a consequence, prices have ruled very firm with a slight upward tendency, the latest quotations for best qualities being 9s. 3d. to 9s. 6d.; seconds, 8s. 3d. to 8s. 6d.; best bunkers, 8s. 6d.; and best Monmouthshire, 8s. The household coal trade, as was to be expected at this season of the year, has been very active, and for No. 3 Rhondda, more than one colliery proprietor is, at the time of writing, full up with orders. 8s. 3d. is the present selling figure of this class of coals, but many owners are sanguine that before long this price will be improved upon. Small Coals.—Small steam, in consequence of the continued activity in the patent fuel trade, and the fact that there was not much large coal cut during the holidays, has been scarce throughout the month, and for ordinary coals 4s. 3d. to 4s. 6d. has been the ruling quotations. Bituminous small, especially No. 3, has also been very scarce, and is likely to continue so as long as the coke trade remains in its present flourishing condition. Towards the close of the month there has been very little No. 3 small on offer, which found ready buyers at from 6s. 9d. to 7s. 3d. Welsh Cokes.—This commodity has been, and continues, in good request at 14s. 9d. to 16s. 9d., according to quality. Pitwood.—There has been a steady demand for good wood, but prices have fluctuated from 14s. 6d. to 15s. 6d., the higher quotation of course being reached through the unpropitious weather delaying the arrivals of cargoes. Iron and Steel.—the demand for manufactured iron and steel of all descriptions has been fairly steady; the following are the latest quotations:—Welsh bars, £4 10s. to £4 12s. 6d.; angles, &c., at usual extras; sheet iron, singles, £7 to £7 2s. 6d. f.o.t. Steel.—Heavy section steel rails, £4 2s. 6d. to £4 5s.; light ditto, £4 15s. to £5 7s. 6d. f.o.t.; sleepers, ties, angles, channels, &c., according to specification and section; steel sheets, singles, £7 10s. to £8 10s., with usual extras for higher gauges; Bessemer steel tin-plate blooms, £4 5s.; ditto bars, £4 15s.; Siemens bars, ditto best, £5 2s. 6d. per ton delivered in the district. Cash, less 2½ per cent. Freights.—The homeward ore trade from the Spanish ports during the early part of the month was very active, but towards the close the market became easier, and as a consequence rates have a slightly downward tendency. In the freight market business on the whole has been fairly active, but the unprecedented fogs which prevailed during the past fortnight had the effect of keeping away tonnage from the port, and as a consequence, during that period, the number of fixtures concluded were considerably below the average. Matters in this direction have now, however, righted themselves, for with the lifting of the fog tonnage poured into the docks. Outward steam chartering is extremely active, more especially for the higher Mediterranean ports, as many as five or six vessels fixing for Port Said. Rates.—Eastern, Spanish, West Indies, Gibraltar, and higher Mediterranean freights are now quoted firm. Coasting freights are quiet, Baltic steady, and there is no change in United States outward freights. Cardiff as a port for Atlantic Liners.—The excitement caused by the announcement of the transfer of the Dowlais Works to Cardiff has scarcely subsided ere another has to be added of almost equal importance to the port. There seems now no reasonable doubt that in a short time Cardiff will become one of the home ports of the Anchor Line of steamers, plying between this country and New York, Halifax, Boston, Bombay, and Calcutta. The Anchor Line includes some of the largest steamers afloat, and when the Roath Dock was commenced it was stated that when completed it would be capable of accommodating such vessels as the *City of Rome*, the *Furnissea*, and others with a carrying capacity of 6,000

Some months since, Mr. Henderson, one of the general managers of the Anchor Line, visited Cardiff, and was so pleased with the Roath Dock and its adaptability for the reception of the large steamers belonging to his company, that on his return to Glasgow negotiations were opened with the Bute Dock Company for the purpose of making arrangements for a regular line of steamers sailing between New York and Cardiff. An Atlantic line of steamers sailing direct from Cardiff would not unnaturally secure a monopoly of the traffic of the very large number of people who emigrate from the Glamorganshire and Monmouthshire valleys, also the enormous number of tin plates which are sent out from South Wales manufactories at present *viâ* Liverpool. The establishment of a line of steamers between the United States and Cardiff would probably also result in a large import trade. It is estimated that at the present time about 1,000 tons of produce are every week delivered in Cardiff. This is now brought by steamers from New York to Liverpool, but when the Anchor Line runs direct it is but reasonable to expect that they will carry almost the whole of the produce required by Cardiff merchants for the town and neighbouring districts. Sir W. T. Lewis and Captain Pomeroy, the dock master, have lately been in Glasgow, and have placed these views before the head officials of the Anchor Line; they were very favourably entertained, and in a short time arrangements will most probably be made for direct communication between Cardiff and America. The Dowlais Company's New Works at Cardiff.—Commencement of operations.—The first sods of the new works to be erected for the company on the East Moors were cut by Mr. G. T. Clark, Sir W. T. Lewis, and Mr. E. P. Martin. It had been arranged that a sod should be cut at the site of each of the three blast furnaces, which comprise the first section of the scheme. Usually furnaces are distinguished one from the other by numbers, but acting on a suggestion made by Mr. Clark, it was decided that in this instance each furnace should bear the name of the gentleman who cut the first sod of the site. The furnaces will be 90 ft. apart from each other. The weather was most unpropitious; rain fell heavily throughout the afternoon. After the sods were cut, the gentlemen above named and their friends, numbering about fifty, assembled together on a rising mound, and hearty cheers were given for Lord Wimborne and Mr. Clark, the Marquis of Bute and Sir W. T. Lewis. The proceedings soon after terminated, and an important venture which assures to Cardiff a prosperous future was formally launched. Another industry for Cardiff.—The projected removal of the Dowlais Iron Works to Cardiff appears to have attracted the attention of capitalists in the great industrial centre of the kingdom. When the Dowlais Company resolved to erect new and gigantic works on the East Moors it was generally conceded that other important industries would follow in the natural course of events. A number of Lancashire gentlemen who are able to command a large foreign trade, and who are thoroughly conversant with all the requirements of the cotton trade, are seeking to acquire land beyond the East Moors, as popularly known, the property of Lord Tredegar, on which to erect eleven cotton mills—about 50,000 spindles each. This represents an expenditure of about half a million pounds sterling, and the employment of about three thousand persons.

Newport.—The demand for coal of all descriptions has throughout the month been very large, but prices have not appreciably advanced, though the market continues very firm. There has been very little change in the iron trade, the works in the immediate neighbourhood are fairly well off for orders, and prices for all descriptions of iron and steel are only steady.

Swansea.—The merchants of this port have been considering the advisability of concerted action for the purpose of maintaining fair and remunerative prices for tinplates. The idea has been warmly taken up, and resulted in the formation of a committee for this purpose. The combination is formed by the tin plate makers themselves, and their scheme is being formulated and perfected quite independent of any association with the block tin ring, and will be more on the basis, or assimilated to the recent Steel Rail Association. The standard minimum price for tin plates, latest quotation, is 15s. B. V. grade. Tin.—The price of Straits and Australian are steadily maintained, £167 for prompt delivery, forward parcels being done at irregular prices, three months' delivery realising £145 to £148; and February, £162 to £163, ex warehouse. The latest quotation being £167 for prompt, £163 5s. February, and £160 March. English refined, £163 10s. delivered. Copper.—The price of Chili bars have been advanced to £85 15s. fourteen days, the prices subsequently declining to £84 5s., £82 12s. 6d., and £82 7s. 6d. S.C., three months being quoted at £83 5s. Prices have declined since, and the latest quotations are £75 15s. prompt, and £77 three months. The fall was initiated by the Syndicate Brokers, and as they still hold nearly the whole of the visible stock of Chili bars, they have evidently some ulterior object in view. Block Tin, £166 10s. to £167. Spelter, £21 10s., steady. Market still strengthening. Lead, £15 for English; Spanish, £14 15s. Anthracite Coal.—Best big vein, 10s. 3d. to 10s. 6d. (selected); unselected, 8s. 6d. to 9s. 6d.; seconds, large, 7s. to 8s. 6d.; small nubbly culm, 4s. 3d. to 4s. 6d. per ton, all delivered f.o.b. Swansea. Cash, thirty days, less 2½ per cent. Steam Coals, 8s. to 9s. 6d., and bunkers, 6s. 9d. to 8s., according to quality. Small, 4s. 6d. to 5s. 3d. per ton, f.o.b. Swansea. Cash, thirty days, less 2½ per cent. Bituminous Coals.—Large, 8s. 6d. to 9s. 6d.; through coal, 7s. to 8s.; small, 5s. 6d. to 6s. 3d. per ton, f.o.b. Swansea. Cash, thirty days, less 2½ per cent. Coke.—Foundry, 15s. to 17s., and furnace, 12s. to 12s. 6d. per ton, f.o.b. Swansea, less 2½ per cent. Iron Ore.—Owing to a slight advance in freight, iron ore has exhibited a corresponding firmness, being 12s. 6d. to 12s. 9d., with an additional charge of 1s. to 1s. 6d. per ton for selected large, ex ship, Swansea. Net cash, thirty days. Pitwood.—There has been no variation of price lately, the last reported being 16s. 6d. to 16s. 9d. per ton in truck alongside. Net cash, thirty days. Freights have a tendency towards firmness. Those for home with Spanish ore have slightly advanced. As regards the coal trade of this port the outlook for the year is very cheering. In this connection we may state that a project has just been perfected for the extension of the Mumbles and Swansea Bay Railway, and the erection of a huge pier at its further extremity, where vessels, conveying both passengers and cargo, could be accommodated at all states of the tide, and irrespective of wind and weather. The company propose to lay down a double line about a mile in length from the present terminus to the Mumbles Head, abutting on a point nearly opposite the lifeboat station, and to build and equip with the most modern appliances a deep water pier with wharves at its sides, and four lines of rails running to its extremity. There will be plenty of sidings, &c., and accommodation will be afforded to the largest steamers, or other vessels, carrying either passengers or coal, or general cargoes. This pier will be quite independent of the tides, like the harbour at New York, and the promoters of the scheme feel that its completion will meet a long felt want, not only as far as Swansea is concerned, but also all the South Wales ports. The total length of the pier will be about 1,000 ft.; but at about 300 ft. from the end it will swell out in a fan shape until it presents a face to the sea of 250 ft. These two sides and the face will be fitted up with complete wharfage accommodation, and will therefore serve the requirements of any two of the largest steamers afloat and one ordinary vessel at the same time. The depth of water at the pier head will be 60 ft., at low water spring tides 30 ft., and neap tides, of course, a greater depth. As regards railway facilities, there is a direct service to Birkenhead over the Midland, the Neath and Brecon, the Mid-Wales, the Cambrian, and the Connah's Quay Railways. On the other hand, by means of the Rhondda, and Swansea Bay, and the Pontypridd and Caerphelly Railways, Newport can be reached. This latter line runs through the centre of the South Wales coal field, and is capable of drawing a very large quantity of the Welsh steam coal, both north and south of its route, to the proposed pier. The main feature of the whole affair is that no dues, tolls, or other levies will be charged; the company will be satisfied with the ordinary returns upon the conveyance of the cargo carried, and, consequently, there will be no need to seek parliamentary powers, and the work may be commenced at any moment. Vessels can load safely at the wharves, and the pier is well sheltered from the prevailing winds. The necessary capital will be £50,000; but Messrs. Sheppards, Pelly & Allcard, one of the oldest and richest stockbroking firms in London, are backing the company up. A 999 years' lease has been obtained upon moderate royalty terms from the Duke of Beaufort. A provisional contract has been entered into with Messrs. Lucas and Aird, the builders of the Tilbury Docks, &c., for the construction of the line, and Messrs. Horsley & Co., for the erection of the pier, which will be of iron piles. Mr. Abernethy, of London, son of the famous engineer, will look after the work, which the contractors say will be finished within six months. The execution of the contract will, it is said, be begun next April.

William Braham Robinson.—We regret to announce the death, from apoplexy, of Mr. William Braham Robinson, late chief naval constructor at Portsmouth Dockyard, from which he retired in 1881.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE prospects of shipbuilding and marine engineering on the Clyde for the year just entered upon are very encouraging. The rush of contracts placed during the months of November and December of last year has resulted in many of the yards being fully occupied, and the orders which have been coming in since that time have caused some yards to resume operations, which for a considerable period have been closed. The tonnage of the newly-ordered vessels added to the work in hand, shows that there are at present under contract with Clyde builders, 136 vessels, measuring about 250,800 tons. This is 120,000 tons more than the tonnage of ships building in July last, about 133,000 tons in excess of those under construction at the beginning of last year, and about 108,000 tons over those building in January, 1886. The work on hand is greater in measurement than the work completed last year, by about 65,000 tons, which is a sufficient guarantee that the prospects of the year now entered upon are brighter than were those of 1887.

The steelmakers, indeed, are so busy at present that it is all but impossible to obtain anything like immediate delivery of plates, angles, &c., for ships now being contracted for. On this account we hear of at least one case in which it has been determined to change the material for constructing a vessel from steel to iron, in order that it may be built within the specified time.

The most important order booked is that secured by Messrs. Wm. Denny & Bros., Dumbarton, for the construction of two steel screw steamers, each of 5,000 tons, for the Compania Transatlantic of Barcelona. These vessels, which are to have great speed and large passenger accommodation, are for the Spanish mail service, a contract having been entered into between the Compania Transatlantic and the Spanish Government. Messrs. A. McMillan & Son, of the same town, have secured an order for a good-sized steamer for French owners. These important additions to the work in the Dumbarton yards have greatly improved the state of trade in the town.

Another order of importance is that secured by Messrs. A. and J. Inglis, Pointhouse, Glasgow. This is for two steel screw steamers, of about 4,000 tons each, for the British India Steam Navigation Company. The steamers will have powerful triple-expansion engines, to be constructed at Messrs. Inglis's works at Warroch Street, Glasgow. Messrs. Inglis have also secured a contract for a steel steam yacht of 300 tons, which is also to have triple-expansion engines to propel her at a high rate of speed.

Messrs. Thomas Dunlop & Sons, Glasgow, have contracted with Messrs. Alex. Stephen & Co., Linthouse, for a steamer of about 3,000 tons gross for the Eastern trade.

Messrs. Napier, Shanks & Bell, Yoker, have secured an order for a large paddle steamer, similar to the *San Martin*, recently constructed by them, but of larger dimensions, for trade in Japanese waters. This makes two large vessels the firm have on hand.

The Admiralty have instructed Messrs. Caird & Co., Greenock, to proceed with the necessary repairs of the steering gear of H.M.S. *Ajax*, guardship, at the Tail of the Bank, which was broken during a terrific storm she encountered about a month ago, while she was proceeding to Stornaway, in connection with the crofters' agitation in the Lews. A limited time has been assigned for making the repairs.

Messrs. Bow McLachlan & Co., Thistle Works, Paisley, have concluded a contract with Messrs. Thos. Cook & Son, tourist agents, London, to build three paddle-steamers for service on the river Nile. These vessels are to be fitted with triple-expansion engines and locomotive boilers, and are to have all the latest improvements for first-class steamers. The same firm have also booked an order for two sets of twin-screw engines for the India General Steam Navigation Company, of Calcutta, for service on the river Ganges.

In Port Glasgow, all the shipbuilding yards (excepting that of Messrs. Blackwood & Gordon, which we note as in the market for sale), have succeeded in securing a share of the contracts that were going, and trade, in all likelihood, will, during the present year, be very busy.

Messrs. William Hamilton & Co. have secured an order to build a steel screw steamer, of 2,500 tons deadweight carrying capacity for Messrs. Strong, Reid & Page, Liverpool. The steamer will be supplied with triple-expansion engines by Glasgow engineers. Messrs. Hamilton have just laid the keel of a twin-screw passenger steamer for the Hamilton Steamship Company, for service on lake Ontario. Her principal dimensions will be, length 155 ft., breadth 24 ft., depth 17 ft. 3 in. moulded. Mr. William Kemp, engineer, Govan, will supply her machinery, which will be of the twin-screw triple-expansion type. Messrs. Robert Duncan and Co. have secured a contract to build a sailing ship of 1,500 tons for Glasgow owners.

Messrs. D. & J. Dunlop & Co., Inch Works, have booked an order to build and engine two steel screw steamers, of 500 tons gross register, each for passenger and general cargo trade, to class 100 A1 at Lloyd's. These steamers will be supplied by the builders with powerful triple-expansion engines to give a high rate of speed. It may be added that this is the first contract of any value that Messrs. Dunlop have had for two years back.

In view of the improvement of Clyde shipbuilding, the shipbuilding yard, engine, and boiler works, known as the Castle Shipbuilding Yard, Port Glasgow, occupied till recently by Messrs. Blackwood & Gordon, were offered for sale in the Faculty Hall, Glasgow, towards the end of December. The works cover an area of fully six acres, and the buildings include the engine, boiler, smith, and joiners' workshop, while there is a steamer of 3,600 tons deadweight, partly constructed, on the stocks. The upset price was £40,000, but as there were no offers the sale was adjourned.

The Grangemouth Dockyard Company have secured a contract from Messrs William Christie & Co., of London, for a steel-screw steamer of 2,000 tons deadweight, to be employed chiefly in the Baltic trade. The engineers are Messrs. Hutson & Corbett, Kelvinhaugh, Engine Works, Glasgow.

The work of harbour extension, which has been going on at Ardrossan for about a year, is proceeding rapidly, and the prospects of a large augmentation in the shipping trade of the port are becoming more and more encouraging, especially as the new line of the Lanarkshire and Ayrshire Company will be opened into the harbour in the course of time. In two parts the excavations have reached the required depth of 21 ft. 9 in. below the original surface, and as the day lengthens the present squad of about 700 workmen will be augmented, while even now night and day shifts will be employed. The channel between the lighthouse and the Crinan Rock will be 600 ft. wide, while the depth of water at the new harbour will be 18 ft. at low water, and 27 ft. at high water. The area of the new dock will be about 10 acres, while the new outer basin will reach 7 acres. Every modern appliance for the speedy loading and discharge of vessels will be furnished, and the new harbour, when completed, will largely increase the trade of the port.

Early in the month it was intimated on the Clyde that it had been finally arranged that Mr. Bryce Douglas, formerly of the Fairfield Engineering Company, should take command of the large shipbuilding works at Barrow, under the new *régime*, which includes the Duke of Devonshire on the board of directors, and the Marquis of Hartington as chairman. The manager of the shipyard, under Mr. Bryce Douglas, will be Alex. Adamson, formerly of the Clyde, and recently with Armstrong Mitchell and Co., on the Tyne, and another Fairfield gentleman will probably be appointed to the engine department. The combination is thus a powerful one, and being composed, for the most part, of Clyde men trained in the principal establishments of the Clyde, they may be expected to give a good account of themselves.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Since the opening of the year, inquiries for new tonnage have somewhat fallen off, and though the outlook for the year is decidedly cheerful, it is not going beyond the truth to say that the month of January has not added much to builders' prospective engagements. There is indeed abundant evidence to show that since freights have exhibited a tendency towards retrogression, the revival in the shipbuilding industry has experienced a check, and though this will, in all probability, prove to be but temporary, its presence is for the moment very generally felt and acknowledged. The amount of tonnage placed for building, however, during the later weeks of last year, is sufficient to keep the majority of establishments in every shipbuilding district fully employed for at least the first half of the present year, and the very eagerness of shipowning firms to provide for future wants has been itself a potent factor in bringing about the lull in

business alluded to. The leading Tyne builders have been exceptionally fortunate in providing against idleness in their yards. Messrs. Armstrong, Mitchell & Co. have secured orders for both their Elswick and Low Walker yards, and at each establishment active preparations are now being made for making a commencement upon new and important contracts. Messrs. Hawthorn and Leslie are at the time of writing busily preparing to launch a magnificent steamer ordered from them by Messrs. Milburn, of Newcastle. This will be the second vessel launched within a short period for the same owners. The firm have lately been commissioned by the owners of the "Gulf" line of steamers to construct four vessels of the largest class, which are to be employed in the same trade as the steamers *Gulf of Aden* and *Gulf of Trinidad*, built at Middlesbro' last year. Messrs. Stephenson & Co., having launched their first steamer, called the *Endeavour*, and built to the order of Messrs. McIntyre, have now commenced the framing of a second, and have placed the keel blocks for a third. Messrs. Swan & Hunter have put down the keels for three large vessels during the month, and a fourth berth is being prepared for occupation. The construction of a vessel which has stood in frame for three or four years has been resumed, and it is now nearly ready for launching. Messrs. Wood & Skinner launched the last vessel on their stocks in the second week of the month, but they have others to lay down, and are now awaiting the arrival of frame material for a vessel of large dimensions. The Tyne Shipbuilding Company have put a night shift on at the frame furnaces, and the keels for two vessels of a first-class type are laid. These are not the only orders recently acquired by the firm, whose reputation for excellence of work is well established. They are now arranging to light their establishment by means of the "Lucigen" light, which has already been introduced in some of the other large shipbuilding concerns in the North. Messrs. Palmer are rapidly filling up their empty berths, and are keeping their frame furnaces going night and day. Messrs. Edwards and Messrs. Readhead are each having a good supply of work, and the Tyne Engineering and Dry Docks Company, South Shields, are just now having some important repair contracts in hand. The North Engineering Company, Wallsend, have, during the month, fitted with engines and boilers two vessels, one of which was built at Blyth and the other on the Tyne. Messrs. Palmer and Messrs. Hawthorn & Leslie are each engaged in engining large vessels which have been launched from their respective establishments. Messrs. Black & Hawthorn, Gateshead, have secured orders for marine work, and the same activity which has distinguished the other departments of the establishment for some months past will now be imparted to this. The firm are making arrangements to manufacture gas engines on a more extended scale than hitherto. Their speciality is the "Beck" engine, which is steadily advancing in public favour. Messrs. H. Watson and Sons, of the High Bridge Works, Newcastle, are pressed with orders for their various specialities, and great activity exists in every department of their works. Messrs. Donkin & Nichol, of the St. Andrews' Engine Works, are completing the contract to fit electric bells in the armour plated ship *Victoria*, now lying beside the Elswick yard. This firm have also the contract to fit electric bells and telegraphs in the three large passenger steamers building by Messrs. Palmer for Messrs. Alexander & Co., of Liverpool. Messrs. Nicholson's boiler factory, Hebburn, which for some time past has been rather slack, is now quite full of work, the orders in hand including boilers of both the marine and stationary type. The recently developed activity in marine engine building has largely added to the briskness already existing at Messrs. George Angus & Co.'s leather and india rubber works, where orders, both from home and foreign sources, are now exceedingly plentiful. The Mica Lubricant Company, South Shields, are also rapidly extending their operations, the demand for their speciality continuing to increase as its qualities become better known.

The Wear.—At the North Sands yard the whole of the building berths are now filled, and an exceedingly busy scene is presented. The firm are engaged in carrying out extensive repairs to the steamer *Foyle* (built by themselves), which went ashore near Malta while on her first voyage, and had to be temporarily repaired at Malta before she could be brought home to undergo a thorough overhaul. The Strand Shipbuilding Company have, after several months' idleness, just commenced frame-turning for a vessel, and they have another to follow. They have also a good repair contract in hand. Messrs. Austin and Messrs. Blumer are each preparing to lay down a vessel, and, in both cases, there is other work in progress. Messrs. R. Thompson & Sons are preparing to launch a large vessel, and are engaged in framing another. Messrs. Doxford have orders for five vessels, the construction of the first of which has been commenced. Messrs. Short Brothers launched the s.s. *Scottish Prince* early in the month, and will soon have another ready for leaving the stocks. In the large engineering works great activity exists, and the foundries are, without exception, full of work. Two forges that have been idle have recommenced work lately, and others are expected to resume operations at an early date. Messrs. C. and M. Douglas's Low Quay and Bedford Street establishments are kept steadily going with the manufacture of patent telegraphs, boiler filters, and other specialities, and Mr. A. A. Rickaby, of the Bloomfield Engine Works, is daily receiving new orders for his patent pistons, piston-rod packing, &c. Messrs. John Lynn and Co., Pallion, have, among other contracts, the steering gears for two fast passenger steamers building on a neighbouring river to supply. At the Palmer's Hill works, orders for Dickinson's patent crank shaft are pretty numerous, and are helping materially to increase the general briskness of the establishment.

The Hartlepools.—Messrs. H. Gray & Co. are actively preparing to commence work in their new yard, and in a few weeks from now several vessels will be laid down there. By launching a large vessel early in the month, the firm have made their first contribution to the unprecedently large output which it is expected will distinguish their establishment in the present year. Messrs. Withey & Co. have their berths fully occupied, and the frame furnaces continue to be kept going steadily. The Central Marine Engineering Works are, if possible, developing greater briskness since the opening of the year, and at Messrs. Richardson's establishment business is also unusually brisk.

The Tees.—Messrs. Richardson & Duck, and Messrs. Craig, Taylor & Co., Stockton, have each booked orders lately, and their yards are already assuming an appearance of considerable briskness. The Stockton Forge is now quite busy, and Messrs. Riley Brothers' boiler works are more actively employed than they have been for years. In the latter instance new machinery is being put down, and an extension of the premises is contemplated. A special class of work with which the firm are largely engaged just now, consists of donkey boilers of the marine type, and it may be stated that a large proportion of the orders for these specialities have come from shipbuilders on the Tyne and Wear. Messrs. Raylton, Dixon & Co., Middlesboro', are preparing to launch a large vessel, and they have three others in comparatively early stages on the stocks. The frame furnaces are kept going night and day, and it is understood that the firm have orders for several large vessels besides those now in progress. It is stated that the other shipbuilding firms at this centre have also obtained orders for new vessels, and there is besides a considerable amount of repair work coming to the port. Marine engineers, both here and at Stockton, are busy, and bridge builders, iron founders, &c., are doing well. The steel works are in every instance pressed with orders, but at the time of writing a wages dispute is temporarily impeding operations at one important establishment.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

Afghanistan.—On December 29th Messrs. Richardson, Duck and Co. launched from their building yard at South Stockton, a handsome iron sailing ship of a large tonnage. The principal dimensions are:—Length (extreme), 305 ft.; breadth (extreme), 42 ft.; depth of hold, 24 ft. 7 in.; tonnage, gross (about), 2,280 tons. She will be rigged as a four-masted barque, has a full poop aft, with saloon and accommodation for captain and officers. The crew are berthed in a large house on deck forward. The vessel, which has been built to the order of the British Eastern Shipping Company (Limited), of Liverpool, will be fitted with steam power for the working of cargo and Emerson Walker & Co.'s patent capstan windlass. Her deadweight carrying capacity is about 3,400 tons. As the vessel was leaving the ways she was gracefully christened the *Afghanistan* by Miss Macdonald, sister of James Macdonald, Esq., of Liverpool, the managing owner.

Cabo San Antonio.—On December 29th there was successfully launched, from the yard of Messrs. Joseph L. Thompson and Sons, North Sands, a handsomely modelled steel steamer, named the *Cabo San Antonio*, built for the Spanish line of Messrs. Ybarra and Co., at Seville. The vessel is of the following dimensions:—Length, 260 ft.; breadth, 26 ft.: depth, 23 ft. 6 in. She has

been constructed on the longitudinal double bottom system, under special survey for the highest classification. The chief or main saloon will be handsomely panelled and the floor laid with tiles. There is accommodation for twenty first-class passengers, with ladies' cabins, lavatories, &c. The engines are of the triple-expansion type, of 700 H.P., and have been constructed by Messrs. Blair & Co., Stockton-on-Tees. She is fitted with Emerson Walker & Co.'s patent windlass. This is the fifth vessel built by the firm for Messrs. Ybarra & Co. The ceremony of naming the vessel was performed by Mrs. Chas. E. Thompson, of Eden Place, Fulwell.

Twickenham.—On December 31st Messrs. W. Gray & Co. launched a fine steel screw steamer, of the following dimensions:—310 ft. by 38 ft. 6 in. by 23 ft. 3 in., moulded, to carry 3,850 tons, and built to the order of Messrs. Watts, Ward & Co., London, and classed 100 A1 at Lloyd's. The vessel is of the well-decked type, with poop aft, containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for crew. The usual topgallant forecastle is fitted forward with Emmerson Walker's direct steam capstan windlass. The hull is built on the web-frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers. A cellular double bottom is fitted throughout for water ballast. The vessel will in every respect be well equipped for general trading. The engines, which are on the three-cylinder triple-expansion principle, are being supplied by Messrs. Blair & Co. (Limited), Stockton-on-Tees. The vessel and machinery are being superintended by Captain T. Hodgson and Mr. Alchen respectively on behalf of the owners. The ship was gracefully christened *Twickenham* by Miss Appleby, of Greatham.

Clandeboye.—On January 12th Messrs. Richardson, Duck and Co. launched, from their building yard at South Stockton, a steel screw steamer of the following dimensions:—Length, over all, 286 ft.; breadth, extreme, 37 ft. 2 in.; depth in hold, 20 ft. 7 in.; gross register tonnage, about 2,190 tons. The vessel, which has been built to the order of Messrs. Carlisle & Co., London, is of the long bridge type, and has a carrying capacity of 3,250 tons. She is fitted with water ballast all fore and aft, on the cellular principle, has a steam steering gear, stockless anchors, self-closing patent freeing ports, and all modern improvements. She will be fitted with triple-expansion engines, 22in, 36 in., 59 in. by 39 in. stroke, by Messrs. Blair & Co., Stockton. As the vessel was leaving the ways she was gracefully christened the *Clandeboye*, by Mrs. Elvidge, wife of Captain Elvidge. The *Clandeboye* will be finished under the superintendence of Mr. C. P. W. Bond, consulting engineer, of 27, Leadenhall Street, London, and of Captain Elvidge, who will take the command.

Gabalva.—On January 12th there was launched from the shipbuilding yard of Messrs. Wood, Skinner & Co., Bill Quay, a steel screw steamer, built to the order of John H. Wilson, Esq., of Cardiff. Her principal dimensions are:—Length, 269 ft.; breadth, 36 ft.; depth of hold, 17 ft. 11 in.; with a deadweight carrying capacity of 2,500 tons. She has been built under Lloyd's special survey, and will be classed 100 A1. The building of the vessel has been superintended by Mr. C. H. Smith, of Newcastle, instructed by Mr. Aisbitt, of Cardiff, and the engines have been built under the supervision of Mr. E. A. Wilson, of Cardiff. The engines are by the North-Eastern Marine Engineering Company (Limited), Wallsend, built on the triple-expansion system, having cylinders 20 in., 33 in., and 54 in. diameter, and 36 in. stroke, and capable of indicating 800 H.P. The vessel, which was named the *Gabalva*, has been specially built for the Atlantic and general trades, and is fitted with all modern appliances for efficient working. The christening ceremony was performed by Miss Laura Wilson, of Newcastle-on-Tyne, and immediately after the launch the vessel was towed to Wallsend to receive her engines.

Godmunding.—On January 13th the Blyth Shipbuilding Company (Limited), launched from their yard at Blyth, a screw steamer 242 ft. long, 33 ft. beam by 16½ ft. depth of hold, built for the firm of Messrs. W. Lamplough & Co., of London, and under the superintendence of Mr. I. C. Jobling, inspecting engineer, of Newcastle. The vessel is built on the well-deck principle with long raised quarterdeck, bridge amidships, topgallant forecastle, customary waterballast arrangements, and to Lloyd's highest requirements. The cabin accommodation is under the bridge deck. There are four large hatches for cargo, with four of Messrs. John Smith & Son's powerful steam winches to work same. Messrs. Harfield's patent windlass is placed on the forecastle deck. Messrs. Donkin and Nichols' patent combined steam and hand-steering gear is fitted in wheelhouse on bridge deck, and a hand-steering gear aft. The engines are of the triple-expansion type of 150 N.H.P., and will be fitted by the North-Eastern Marine Engine Company (Limited), Wallsend. As the vessel left the ways she was named the *Godmunding* by Mrs. John Nixon, of Blyth. Immediately after the launch, the vessel was towed to the Tyne by two powerful Blyth tugs, to have her engines and boilers placed on board.

Endeavour.—On January 14th Messrs. Robert Stephenson and Co., locomotive and marine engineers and shipbuilders, launched the first vessel that has been built at their yard at Hebburn. This yard was originally opened by Messrs. McIntyre & Co. (Limited), but after four ships had been built it was closed for a considerable time, being ultimately purchased by Messrs. R. Stephenson & Co. (Limited), of Newcastle, who added shipbuilding to their engineering work, and practically commenced active operations in the spring of last year. The vessel in question has been built to the order of Messrs. McIntyre Bros. & Co., London and Newcastle. The dimensions are:—Length, 300 ft.; beam, 40 ft.; and depth, 27 ft. 1 in. It is a spar-decked steel cargo boat, but as it has been fitted with lofty 'tween decks and tastefully-arranged cabins aft, it will be available for carrying emigrants. She is fitted with the "sentinel" steam steering gear by Alley and McLellan, of Glasgow, and Harfield's patent steam windlass. A water-ballast tank, in a double bottom, has also been added, and the ship will be fitted with triple-expansion engines, having cylinders 22½ in., 37 in., and 61 in. in diameter, with 42 in. stroke, and boilers of a working pressure of 170 lbs. to the square inch. The tonnage of the vessel is 2,600 gross. The vessel was christened the *Endeavour* by Lady Pease.

Kittie.—On January 14th Messrs. W. Gray & Co. launched a fine steel screw steamer of the following dimensions:—Length overall, 294 ft.; breadth, 37 ft. 6 in.; depth, moulded, 22 ft. 2 in. of large deadweight capacity; built to the order of Messrs. J. Coverdale & Son, West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well decked type with poop aft, containing saloon and cabin for officers and a few passengers. Comfortable quarters for the crew are provided in the fore part of the bridge. The forecastle is fitted forward with Emerson, Walker & Co.'s capstan windlass. The hull is built on the web frame principle, dispensing with hold beams and giving a clear hold for working cargo, five hatches are fitted, four steam winches, steam steering gear, and a large donkey boiler. A cellular double bottom is fitted throughout for water ballast. The vessel will, in every respect, be well equipped for general trading. Triple-expansion engines, of the most approved design and construction, are being supplied by the Central Marine Engineering Company, West Hartlepool, with three cylinders, 22 in., 35 in. and 59 in. diameter, and 39 in. piston stroke. Two large boilers, made of steel, for a working pressure of 160 lbs. per square inch, will give an ample supply of steam for working the engines at 1,000 I.H.P. The ship was gracefully christened *Kittie* by Mrs. J. R. Butterwick, of Hartlepool.

LAUNCHES—Scotch.

Mamelena XI.—On December 13th Messrs. W. B. Thompson and Co. (Limited), Dundee, launched a small steel screw steamer, which has been built for Spanish owners. She is a vessel of 80 tons gross, named the *Mamelena XI.*, and is being supplied with triple-expansion engines of 45 N.H.P. by the builders.

Oonah.—On December 17th Messrs. A. & J. Inglis, Pointhouse, Glasgow, launched a steel screw steamer, named the *Oonah*, which has been built for the Tasmanian Steam Navigation Company, Hobart, being intended for their intercolonial trade. A vessel of 290 ft. by 35½ ft. by 24½ ft.; she has been constructed with all modern improvements, including water ballast, and will have accommodation for 80 first-class and 30 second-class passengers, having at the same time a large cargo-carrying capacity. Her fittings will include Brown's hydraulic and steam starting gear. Weir's patent feed-heaters and evaporators, an electric light installation for every part of the vessel by Messrs. Harvie & Co., Glasgow; steam steering engine by Messrs. Muir and Caldwell; and steam windlass and double-screw hand-steering gear by Messrs. Napier Brothers, Glasgow. When finished the *Oonah* will be one of the most complete vessels of her class. She will be driven by a set of triple-expansion engines

embracing all the most recent improvements, and worked with steam of 160 lbs. pressure. She was launched within five months of the order being placed with the builders.

Tug.—On December 30th Messrs. A. M'Millan & Son launched from their dockyard at Dumbarton, a small tug steamer for French owners.

Anshin-Maru.—On January 2nd, at the shipbuilding yard of Messrs. Pearce Brothers, Dundee, there was launched a passenger screw steamer named the *Anshin-Maru*, the first of a fleet intended to run upon the Japanese coast. The vessel is to be fitted with force draft and thoroughly balanced engines, and is expected to attain a speed of 14 knots per hour. She is built to the order and design of Mr. James J. Pearson, Newcastle, who represents a large Japanese syndicate in this country. The christening ceremony was performed by Mrs. R. A. Pearce.

Lady Ailsa.—On January 4th, the Ailsa Shipbuilding Company, Troon, launched from their yard a steel screw steamer for Messrs. J. & A. Wyllie for their trade between the Clyde and Mediterranean ports. Dimensions: Length over all, 240 ft.; breadth, 33 ft.; depth, moulded, 18 ft.; gross tonnage, 1,250 tons. Built under special survey and classed at Lloyd's 100 A1; fitted with full poop and bridge-house combined, and topgallant forecastle, water ballast fore and aft, steam steering gear, steam windlass, steam winches, and all latest appliances. She is to be fitted by Messrs. David Rowan & Sons, of Glasgow, with three crank triple-expansion engines, having cylinders 17 in., 27 in., and 44 in. by 36 in. stroke, with boiler to carry a working pressure of 150 lbs. In the absence of Lady Ailsa, the christening ceremony was performed by Miss Mary Ann Wyllie, who named the steamer the *Lady Ailsa*.

Retriever.—On January 7th a steamtug was launched from Messrs. W. B. Thompson & Co.'s Caledon Shipbuilding Yard, Dundee. She is built for the Retriever Steamship Company (Limited), Liverpool, for towing service on the River Hooghly, having special regard to the peculiar nature of the currents of that river, the climate, and the trade. While the vessel was leaving the ways she was christened *Retriever* by Miss Corsar, daughter of Mr. C. W. Corsar, of Seaforth, Arbroath. The *Retriever* is a vessel of 750 tons gross register, is fitted with engines of 400 N.H.P., and has been built to the highest class at Lloyd's. She is of the following dimensions:—Length over all, 218 ft.; breadth, extreme, 31 ft.; and depth of hold, 15 ft. 6 in. She will be propelled by twin screws, each driven by independent engines. These, which are Mr. Thompson's patent triple-expansion type, are an exact duplicate of each other, with cylinders 19 in., 33 in., and 54 in., with a piston stroke of 33 in. These are expected to drive the vessel at a high speed. Steam is supplied by two large double-ended boilers of steel, with 12 furnaces, which have been specially constructed to burn, if necessary, inferior coal. Two funnels, each double-cased to the top, surmount the boilers, and form an imposing feature of the vessel. The towing gear is of an unusually substantial character, and is arranged to suit the special requirements of the trade for which the *Retriever* has been built. The method of towing is somewhat different from that employed in this country. The tow-rope is brought in over the stern over the usual bridges found on all tugboats, and then (instead of being put over the usual slip-hook) is passed round a revolving sheave placed where the towing hook is in other tugs. Leaving this sheave the rope is brought aft and passed two or three times round a large steam capstan, and the remainder is passed into the hawser hold below the main deck. This method of towing is used at sea. In any narrow or confined channel, however, the method is varied by the employment of two ropes, brought aboard as in the previous case, but led from the midship sheaves each to a separate steam capstan (of which the *Retriever* has two), where they are hauled in and stacked away, as occasion may require, with the utmost ease and precision, the controlling gear for these capstans being placed on the bridge deck close to the engine-room telegraph, so that the captain can manœuvre the tugboat by the twin engines, and control the ship in tow with the steam capstans without moving a step. Amidships a long range of iron deckhouses encloses the engine-room, boiler space, and saloon, the whole being bridged over by the hurricane deck, a spacious promenade about 60 ft. long. At the fore end of this deck the navigating platform is placed, containing steam steering gear, binnacle, and engine-room telegraphs, and speaking tubes. Forward, a turtle-back forecastle is constructed, providing protection when ploughing through a head-sea, and under this deck is placed a powerful steam windlass, with capstan on deck above, which can be used in conjunction with a deck crane for raising the anchors. The fore end of the midship deckhouse has been arranged to contain saloon and captain's room, with the usual accessories. The officers are provided with excellent accommodation under the main deck forward, the rooms being of large size and exceedingly well ventilated. Under the main deck aft the crew's quarters have been placed with every convenience that the requirements of a hot climate necessitate. Substantial awnings are fitted over the hurricane deck and forward part of main deck. At each end of the vessel water ballast trimming tanks have been constructed, and the large bunker space available renders the vessel specially suitable for long deep-sea towing. A strong elm fender extends round the vessel, affording much needed protection when coming alongside vessel or quays. She has been rigged as a smack, carrying only one mast, so as to subordinate all her equipment to towing purposes. The *Retriever* is the fifth twin screw steamer built at the Caledon Shipyard, and is about the same dimensions as the *Indra* (now H.M.S. *Hearty*), which was purchased by the Government. As in the case of the *Indra*, the hull, machinery, and boilers of the *Retriever* were all designed and constructed by the builders.

Lady Weld.—On January 10th Messrs. Scott and Co., shipbuilders, Greenock, launched from their yard at Cartsdyke, for the Netherlands India Steam Navigation Company, a steel paddle-steamer of 511 tons register, and of the following dimensions:—Length, 221 ft.; breadth, 30 ft.; and depth, 9½ ft. On leaving the ways the new steamer was named the *Lady Weld*. She will be supplied by the builders with triple-expansion engines, the diameter of the cylinders being 20 in., 30 in., and 48 in. respectively, with a piston stroke of 48 in. The *Lady Weld* is double bowed, and can be steered from both ends, which will enable her to navigate with ease the narrow rivers of the Dutch settlement of Batavia. The steamer is now being fitted out for sea at the Victoria harbour.

Lifeboat.—On January 16th a new lifeboat, 34 ft. keel by 7½ ft. beam, was launched at Irvine, in presence of Provost Watt, members of the Town Council, and a number of the leading inhabitants. The attendance of the general public was rather limited. The arrangements were under the superintendence of Captain Beddoes, R.N., superintendent of lifeboats for Scotland, and were successfully carried through in every particular. The boat, which is not yet named, is similar in style and size to the lifeboat launched recently at Troon, and is estimated to have cost about £400. The chief difference between it and the old boat, the *Isabella Frew*, which it supersedes, is the arrangement for shipping and discharging water ballast. The water ballast, which contributes largely to the self-righting properties of the boat, is shipped in a few seconds to the extent of several tons, and was, on January 16th, while the qualities of the boat were being exhibited, discharged in about a minute and a quarter. After the launch, the boat was pulled a short distance down the river, and then taken back and placed under the jib of one of the cranes at the harbour, where it was capsized, righting itself in about six seconds. The coxswain, Mr. David Sinclair, reports the new boat to pull very much easier than the old one. The N. L. A. have not yet fixed on the donor to their funds who is to have the honour of naming the boat, which is the reason why no christening ceremony took place

Ocean.—On January 18th Messrs. Russell & Co., shipbuilders, Greenock, launched from their yard a large steel screw steamer, the *Ocean*, for the petroleum bulk carrying trade between America and the Continent. The vessel is 310 ft. long, 35 ft. beam, and 25 ft. depth, and is capable of carrying about 3,500 tons of oil. The vessel is divided into 16 oil-tight compartments, exclusive of the water ballast tanks. The tanks have been subjected to exceptionally severe tests before launching, which they stood very satisfactorily. The vessel will be lighted throughout by electricity, and is fitted with a powerful set of Worthington pumps capable of discharging the entire cargo in about 24 hours. Triple-expansion engines will be supplied by Messrs. Duncan Stewart & Co., of Glasgow, the cylinders being 22 in., 36 in., and 58 in. diameter, with a stroke of 42 in. There are two large single-ended boilers, the working pressure being 160 lbs. The *Ocean* has been built to the order of Messrs. Hermann Stursberg & Co., of New York, from the plans and specifications of Messrs. Flannery and Blakiston, consulting engineers, of Water Street, Liverpool, who have also superintended the construction of the vessel. The *Chester*, a sister ship to the *Ocean*, was launched six weeks ago. The managers in this country for both vessels are Messrs. R. W. Leyland & Co., Liverpool.

Sutlej.—On January 18th Messrs. Russell & Co. launched from their east-end yard at Port Glasgow, at high water, an iron sailing ship of the following dimensions:—Length, 260 ft.; breadth, 38 ft.; depth of hold, 23 ft.; and of about 1,660 tons register. This vessel is owned by Messrs. Foley, Aikman & Co., London, and on leaving the ways she was named *Sutlej*. Immediately after the launch she was berthed in the East Harbour, where she will be fitted out.

Amber.—On January 19th Messrs. R. Napier & Sons launched from their shipyard at Govan the telegraph cable steamer *Amber* for the Eastern Telegraph Company. The vessel has been specially designed by Mr. Joseph Birnie, London, for laying and repairing the company's submarine cables, and while externally the steamer has the appearance of a Trinity yacht, internally the arrangements are of the most complete character for the difficult and delicate task she is intended for. Besides the usual appliances of a first-class modern steamer, the vessel is fitted with large circular tanks for holding the telegraph cables, and has been subdivided into numerous watertight compartments for trimming and ballasting purposes. Her dimensions are:—Length, 210 ft.; breadth, 31 ft.; depth, 24 ft.; and she is classed 100 A1 at Lloyd's under special survey. Very complete and comfortable accommodation has been provided for the exceptionally large staff of officers, electricians, and crew, with the necessary chart-house and testing-room, which will be fitted with the best instruments for the task in which the vessel will be engaged. The bow sheaves give the vessel a peculiar appearance, but they have been wrought in by the builders in an ingenious way to form part of a clipper bow, which adds to the symmetry of the design. The machinery will consist of triple-expansion engines, which have been constructed at Messrs. R. Napier & Sons' Lancefield Works, under the supervision of Mr. Beldam, London. As the vessel left the ways she was named the *Amber* by Miss Agnes M. Hamilton. After the vessel was sent on her way up the river to receive her engines the company adjourned to the model room, where a cake and wine luncheon was served. Mr. A. C. Kirk presided, and among those present were:—Messrs. John Hamilton and James Hamilton, jun., Mr. Joseph Birnie, London; Mr. J. M. Renwick, Eastern Telegraph Company; J. Strang, Glasgow, Mr. Alfred Gibb, Eastern Telegraph Company; Mr. Shelton, Royal Mail Steamship Company, Southampton; Mr. Luther, and Mr. Bailey, Glasgow. The Chairman, in giving the toast of "Success to the *Amber*," said she was the fifth vessel which his firm had the pleasure of building for the Eastern Telegraph Company, and he trusted she would give every satisfaction while performing her difficult work. The launch was a most successful one, and his best wishes for the *Amber* were that she would prove a good serviceable vessel. He would couple the toast with Mr. Birnie. Mr. Joseph Birnie, in reply, paid a high compliment to the general workmanship and beautiful lines of the *Amber*, and was sure from what he had already seen of her she would give as much, if not more, satisfaction to the company than the other four which had already been built for them by the Messrs. Napier. Mr. Renwick gave "The Builders" (Messrs. Robert Napier and Sons), and coupled the toast with Mr. James Hamilton. Among the other toasts were "The young lady who named the vessel" (Miss Agnes M. Hamilton), by Mr. Strange; and "The Engineer of the Eastern Telegraph Company" (Mr. Gibb), by Mr. Kirk.

LAUNCHES—Irish.

Sindia.—On November 19th was launched from the building yard of Messrs. Harland & Wolff, Queen's Island, Belfast, the steel sailing ship *Sindia*. This vessel, which is the second largest sailing ship afloat, is of the following dimensions:—Length, 329$\frac{3}{10}$ ft.; breadth, 45$\frac{2}{10}$ ft.; depth, 26$\frac{1}{10}$ ft.; gross tonnage, 3,068 tons; net register tonnage, 3,007 tons. She has four masts, three of them being square rigged.

City of Dublin.—On January 2nd there was launched from the shipbuilding works of Messrs. Workman, Clark & Co. (Limited), Belfast, a steel screw steamer named the *City of Dublin*, for Messrs. Geo. Smith & Sons' City Line of steamships, engaged principally in the Indian trade. As the steamer left the ways, the naming ceremony was performed by Miss Lucy Matier, daughter of Henry Matier, Esq., Fort William Park, Belfast. The dimensions of the vessel are:—Length between perpendiculars, 361 ft. 8 in.; breadth (extreme), 42 ft. 7 in.; depth of hold, 26 ft. 4 in.; gross tonnage, 3,271 (157). She will be classed 100 A1 at Lloyd's, is built to the decked rule, and has two steel decks, the upper one being covered with yellow pine. She is specially designed for carrying large cargoes of grain, shifting boards being fitted fore and aft between a double row of hold pillars. The officers and engineers are berthed in wing houses under the bridge amidships. The ship is divided into eight watertight compartments by steel bulkheads. There are five cargo holds with hatches of extra large size, and each hatch has a very complete arrangement of steam winch and derrick for the rapid discharge of cargo—two of the largest hatches having two winches each. The windlass, which is Harfield's patent, is driven by steam, as is also the steering gear, which is Harrison's patent, and is placed aft of the engine casing on the upper deck. The *City of Dublin* will be rigged as a brigantine. The engines with which the vessel is to be fitted are of the triple-expansion type—diameter of cylinders 25½ in., 42 in., and 67½ in., with a stroke of four feet. She has two double-ended steel boilers, giving 160 lbs. working pressure.

TRIAL TRIPS.

Kwang Chi.—On Thursday, November 17th, the steamer *Kwang Chi* proceeded on her trial trip from the Old Dock Wharf at Shanghai. She has been built by Messrs. S. Farnham & Co., and has the following dimensions:—Length, 192 ft. 3 in.; breadth, 27 ft.; and a draught of 7 ft. 6 in. The propulsion is effected by twin screws, driven by triple-expansion surface-condensing engines, having cylinders 9 in., 15 in., and 25 in. in diameter, with a stroke of 21 in. Steam is supplied from a single boiler 10 ft. in diameter by 12 ft. long, the working pressure being 160 lbs. At the trip a speed of between 11 and 12 knots was obtained, the revolutions being 128 per minute, and the I.H.P. 380.

Sagittarius.—On December 15th the *Sagittarius*, the second of two steam trawling vessels lately built by Messrs. Earle's Shipbuilding and Engineering Company for the Grimsby and North Sea Steam Trawling Company, was taken on her trial trip. The weather was all that could be desired for the purpose, and the trial throughout was of a very satisfactory nature, the engines working very smoothly, and giving no trouble whatever. A trial on the measured mile at Withernsea gave a mean speed of nearly 9¼ knots, with the ship deeply laden and fully equipped for sea. The dimensions are:—97 ft. by 20 ft. by 10 ft. 9 in.; engines, 11½ in., 17 in., and 30 in. by 18 in. stroke.

Exeter City.—On December 23rd the steel screw steamer *Exeter City*, built under contract by the Blyth Shipbuilding Company, Limited, of Blyth, for Messrs. Charles Hill & Sons, of Bristol, had a satisfactory trial trip. This vessel, which has been specially constructed for Messrs. Hill's line, will run between Bristol and New York, carrying general cargo and passengers. The engines, which worked so effectively on the trial trip, were supplied by Messrs. Blair & Co., of Stockton-on-Tees. The *Exeter City* is now loading general cargo in the Tyne for New York, and is under the command of Captain Weiss, who also superintended her fitting out. The general construction of the vessel was under the superintendence of Mr. Bailey, and the engines and boilers of Mr. Scott, both inspectors in Messrs. Charles Hill & Son's employ.

Chamroen.—On December 24th the new steel twin screw steamer *Chamroen*, recently launched by Messrs. Ramage and Ferguson, Leith, for the Scottish Oriental Steamship Company, Leith, sailed from Leith for Bangkok, Siam, *viâ* the Suez Canal, under the command of Captain Jones, late of the steamer *Abbotsford*. This steamer, which is 160 ft. long by 28 ft. beam, has been built expressly for navigation of the shallow waters of the River Meinam, and carries a large cargo on a light draught. On her trial trip on December 22nd, with over 400 tons on board, she attained a speed of nearly 11½ knots per hour. Her engines during the day worked in a most perfect manner.

Damascus.—On December 28th the *Damascus*, which has been built by Messrs. Robert Napier & Sons, for Messrs. George Thompson & Company's Aberdeen line, went down the Firth of Clyde on her official trials, and attained a mean speed of 14½ knots on the measured mile. The vessel has been specially designed to meet the requirements of the owners' Australian and China trade, and, while capable of carrying a large cargo, she has been fitted for about 50 first-class passengers, and her 'tween decks are admirably adapted for emigrants or the transport service. The dimensions of the ship are:—Length, 350 ft.; breadth, 44 ft.; depth, 33 ft.; with a gross tonnage of 3,800 tons. The hull and machinery have been constructed under special survey at Lloyd's highest class, and all the most recent improvements have been introduced for the efficient working of the vessel and the rapid handling of the cargo. The vessel is fitted with triple-expansion engines indicating 3,000 H.P.

Glanmire.—On December 29th the steel screw steamer *Glanmire*, which was lately built and engined at Dundee by Messrs. W. B. Thompson & Co. for the City of Cork Steam Packet Company (Limited), had her trial trip. In the run from the Buoy of Tay to the Carr Beacon she attained a speed of 13·7 knots per hour.

Hawk.—On January 17th the trial of the new steel screw tug *Hawk* was held on the Thames. Considerable interest was excited, as the proportions of the cylinders were unusual. They were so made by the special desire of the owner, Mr. James Watkins, by Messrs. John Stewart & Son, Blackwall Iron Works. The h.p. cylinder is 13½ in., l.p. 29 in., stroke 18 in., boiler is 9 ft. diameter, 9·6 ft long, with 2·31 ft. furnaces; total heating surface 675 ft., pressure 100 lbs., with 165 revolutions, vacuum 25·5; receiver pressure 10·5 lbs.; the power indicated was h.p. 120·5, l.p. 117, total 237. This was considered highly satisfactory by the numerous experts aboard, and the consumption on a four hours' run compared very favourably with the results obtained from best forms of triple-expansions. Dimensions of hull, 70 ft. by 15 ft. by 8·1 ft.; draught, 8·0; speed, 11 knots. Vessel is classed at Lloyd's, and has a Board of Trade certificate.

Kisanga.—On January 18th the new steamer *Kisanga* went down the river on her official trial trip. The *Kisanga* is a screw-steamer of 1,500 tons, built by Messrs. John Reid & Co., of Port Glasgow, to the order of Messrs. Hatton & Cookson, who intend to run her in their African trade. She has been built under the superintendence and to the specification of Mr. George Hepburn, naval architect and consulting engineer, Redcross Street, Liverpool. The vessel is built of mild steel, and classed 100 A1 at Lloyd's, and has Board of Trade passenger certificate under special survey. Her dimensions are as follow:—Length, 265 ft.; beam, 35 ft.; depth of hold, 18½ ft. The *Kisanga* has been built to replace the *Angola* on the African station, and her owners have in her a vessel well suited for the African trade, for which a light draft is very essential. In this particular the *Kisanga* is well adapted, her draft when fully loaded being only 14½ ft. The crew are accommodated in a topgallant forecastle, the officers and engineers in a house at the fore part of the bridge, which is continued in the form of a shelved deck to the after end of the engine-room. The poop has accommodation for thirty passengers in state-rooms, which are fitted up in the most approved manner. Indeed, in this departure the arrangements are first-class, and the handsome fittings and conveniences for saloon passengers should make the *Kisanga* an even greater favourite than the old *Angola*, which is saying a great deal. The dining saloon, which extends almost the length of the poop, is a handsome apartment, and is framed and panelled in polished hard woods, principally teak, mahogany, and oak. The main entrance is from the poop deck through a deckhouse, which is also fitted in polished work, and is sumptuously upholstered. The ladies' cabin, which enters from the saloon, has been got up in antique oak with fittings and upholstery to match. All the upholstery work has been supplied by the eminent firm of Wylie & Lochhead, Glasgow. On deck are arranged all the most modern appliances for working the vessel, amongst which are noticed Wasteneys Smith's stockless anchors, which stow up in the hawse pipes, Harfield's steam windlass, Amos & Smith's patent steering gear, also Messrs. J. Gordon, Alison, & Co.'s motograph, which indicates and registers every revolution of the engines. As an instance of the usefulness of the latter invention we may here mention, in parenthesis, that the steamer *Clan Macintosh*, fitted with the motograph, registered nearly five million revolutions during her last voyage to Calcutta and back. The machinery has been supplied by the well-known firm of Messrs. David Rollo & Sons, Fulton Engine Works, and consists of a set of their triple-expansion engines having cylinders 25 in., 38 in., and 62 in. diameter respectively, with a stroke of 36 in. The engines are of a very strong design, and the crank shafts are entirely of mild steel on the built principle. The main bearings and crank pin bearings are of white metal, the valve gear is of the double eccentric bar link arrangement, and the starting and reversing is performed by a direct push gear of special design, its action being almost instantaneous. There is a donkey pump fitted for boiler feeding only, while the ballast and bilge donkey supplies water to deck, service pipes being laid the whole length of decks, with hydrants at suitable intervals. This donkey is also arranged to turn main engine for overhauling in port. In connection with this point we may mention a new feature, *i.e.*, a screw-cutting turning lathe, which is fitted in the engine-room, capable of being worked by steam or manual labour. This should be of great value to the engineers when at foreign ports. Steam is supplied by two steel boilers, 12·2 diameter by 14·0 long, having four of Brown's patent ribbed furnaces in each. The working pressure is 160 lbs. per square inch, and all the machinery is fully over the requirements of the Board of Trade and Lloyd's for that pressure. Messrs. Rollo have also fitted three powerful steam winches of Messrs. Dunlop & Bell's make, the winches being of that firm's special noiseless friction principle. Steam for these can be had from the main boilers, or from the large Blake's donkey boiler fitted in the boiler deck-house. Messrs. Rollo deserve very great credit for the completeness with which they have executed their work in every detail. The *Kisanga*, when leaving the Mersey, shaped her course to the Crosby and Formby Lightships, and from thence across to and around the North-West Lightship. A large party of ladies and gentlemen availed themselves of this opportunity to take a very pleasant trip, and expressed their complete satisfaction with all details of the vessel, the machinery in particular being greatly admired. During the trip the vessel attained a speed of thirteen knots per hour, being one knot in excess of the guaranteed speed. The *Kisanga* carries six boats, including two lifeboats and a steam launch, and is commanded by Captain Thompson, late of the *Angola*, a skilful and able navigator.

Corriere di Livorno.—On January 13th the twin-screw steamer *Corriere di Livorno*, recently launched by Messrs. Thomas and William Smith, from their shipbuilding yard, North Shields, for foreign owners, proceeded on her trial trip. She is of the following dimensions, viz., 125 ft. by 23 ft. by 6 ft., with engines 13 in. and 24 in., 18 in. stroke, 50 H.P., supplied by the Wallsend Slipway & Engineering Company, Limited. The vessel was partially loaded with coals, and steamed a little over 11½ miles per hour. The trial was satisfactory in every respect, and, after adjusting compasses, the steamer proceeded on her voyage to Genoa in command of Captain Antonio Massa.

Karagda.—Messrs. A. & J. Inglis, Pointhouse, Glasgow, have recently had a series of very complete speed trials of the steel screw steamer *Karagda*, which they had built for the British India Steam Navigation Company. She is a vessel of 1,168 tons, and is fitted with triple-expansion engines of 1,750 I.H.P. On the measured mile at Skelmorlie she attained a mean speed of 13·85 knots per hour, which was also the result of an extended trial.

City of Berlin.—The official full-power trial of the Inman and International Company's steamer *City of Berlin*, took place last month. The engines were run for several hours continuously at about 66½ revolutions, steam pressure 150 lbs., vacuum 26 in., and giving upwards of 6,000 I.H.P. The boilers, which are worked under forced draught on Howden's closed ashpit system, generated ample steam, and the result as a whole exceeds the most sanguine expectations formed.

Dredger Contract.—The Town Council of Preston have instructed Messrs. Fleming & Ferguson, shipbuilders and engineers, Paisley, to construct a powerful dredger, somewhat larger than the two already built by that firm for the deepening of the river Ribble. The vessel is to be of steel throughout, and is to be capable of dredging 800 tons per hour from a depth of 35 ft.

The Ajax.—The Admiralty have lately shown quite exceptional promptitude. It was at first intended to tow the *Ajax* from the Clyde to a Royal Dockyard in order to repair her steering gear. The fact that the Clyde is a great shipbuilding centre, however, evidently struck the Department in time, and the repairs are to be executed by Caird & Co., of Greenock, near whose premises the *Ajax* is moored.

Launch of a French Cruiser.—A steel steamer of the same class, the *Forbin*, which had been laid down in the spring of 1886, has just been launched at Rochefort. Her principal dimensions are:—333 ft. long, 30 ft. in beam, with an average draught of water of 14 ft. Her double engines are of 6,000 H.P., and her estimated speed is 19½ knots. She has a tortoise-shaped iron-clad deck, running from bow to stern, with a cofferdam 32 in. deep. The quantity of coal carried will be 200 tons, sufficient for her to steam 2,400 miles at 10 knots. Her armament will consist of two 6 in. guns upon the quarterdeck, three rapid-firing guns upon the poop, four revolver guns, and five torpedo tubes. The *Forbin* will carry a crew of 150 men, and her total cost will be £125,000 or thereabouts, of which the hull and body of the vessel will have cost about £77,000, the machinery £44,000, and the guns £4,000. The *Forbin* will be finished this year, and five other cruisers of a similar type—the *Surcouf*, the *Troude*, the *Lalande*, the *Cosmao*, and the *Coëtlogon*—are in course of construction.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

THE MARINE ENGINEERS' UNION.

To the Editor of The Marine Engineer.

Sir,—In your last issue I notice a letter signed "Progress," but I think "Anti-progress" would be a more applicable signature for the writer. Every one is aware that in starting a union of any kind for a large class of society that it is very hard to meet every person's views who compose the members of said union, and the committee, in issuing their circulars, by describing the various benefits and advantages to be aimed at, are only trying to suit the different views of the numerous body whom they are addressing. After the union is properly formed, the votes of the majority of the members are taken after due discussion to settle everything. I agree with "Progress" that a "hot bottom end," caused by the chief engineer neglecting the engines to take the sun, would not be raising his position; but if it suits the engineer to take the sun, there is no necessity for the "bottom end" to heat in consequence, and the engineer won't be taking a thing that belongs to the master or any other person, as the sun is considered common property. Unless the Union makes it compulsatory for me to take the sun, I for one will not complain. I learn from "Progress" for the first time that it is compulsory by Board of Trade for masters to dabble in steam, and very much doubt it. It was usual some years ago, when passing in steam was the rage among masters, for the examiner to bring them on board a steamer and ask them the names and uses of the principal parts of the engines, such as the condenser pumps, &c. That was about all it amounted to, and they just learned enough to make them argumentative and disagreeable to engineers. Regarding his other remarks, about junior engineers and their superior knowledge, I am only too happy to hear that they are so far advanced, and I look for great things from them in the future. Still, if "Progress" is what he professes to be, he must know that a young engineer out of the shop, joining a ship for the first time, has a very imperfect knowledge of his duties, notwithstanding that he may have competed in the grades "Advanced" and "Honours." I was told by a master some time ago that on ringing the telegraph for engines to stop he happened to cast his eyes aft, and saw the third engineer flying along to call the chief instead of stopping the engines as required. His remarks about donkeymen are on the same scale as the others, as he must know that the chief engineer cannot always be standing over the donkeyman to instruct him. The whole tone of his letter seems to me to be trying to cast obloquy on the Union, and all connected with it, instead of displaying some of the "loyalty man to man," the want of which he deplores so much in his letter. He picks out the most unimportant points and flies into print with them, and entirely ignores the vast benefits that must accrue to all connected with the Union if they act in a proper spirit and strive to improve our position and get the confidence and co-operation of our employers. It must always be borne in mind that our interests are inseparable from theirs. The first things we should strive to obtain are better food, better accommodation, and bath-rooms for engineers on eastern-going steamers. These things are essential to health, more especially in warm climates, and certainly require to be altered for the better in a great many of our large steamers. We do not ask for anything but what is fair and reasonable, and, surely, every engineer is entitled to have food fit to eat. It is not the shipowner's wish in many cases that we should be badly fed, but the master, who pockets the money, or accepts the finding of the ship for a sum wholly inadequate for the purpose. I propose that reports of ships badly found in provisions, &c., be lodged with the committee, and the owners of said ships approached on the subject, and I feel certain, with few exceptions, they are too honourable to resist a reasonable demand of that sort. Hoping that "Progress" will see his way clear to become one of us, and strive by all lawful means to raise the position of his brother engineers, I, for one, shall consider it the best investment I ever made if supplied with legal advice when required.

Yours very truly,

South Shields. "UNIONIST."

To the Editor of The Marine Engineer.

Sir,—Your correspondent, Mr. F. Seaton Snowdon, having in last number acknowledged the authorship of a letter signed M.I.M.E. and A.I.N.A. that appeared in your issue for November, I now proceed to keep my word by replying to that letter. It does not matter whether the progress of the Union has been equal to his expectations or otherwise, as he is no authority upon such a subject, but I am glad to inform your readers that it has exceeded the expectations of its founders, and has been so rapid of late that they are now assured it is destined to prove a great and permanent success.

The circulars of the Union give the names of nearly thirty engineers besides myself who manage its affairs; and if your correspondent had but taken the trouble to read one of these circulars, he need not have wasted your valuable space and my time by such useless questions as to what other officials there are besides the Chief Secretary. In reply to his questions regarding the financial arrangements of the Union, I may state that all the books and accounts are open daily for inspection by any member of the Union who may wish to examine them; but the committee have decided that questions put by outsiders regarding such matters are not to be answered, as it is considered by them that such questions can only be prompted by an idle, if not mischievous, curiosity which ought not to be encouraged. I may add that the Union being a *private* association, any further questions of this nature will be regarded as an impertinence, and treated accordingly.

The modesty of your correspondent is clearly apparent in the statement that in HIS opinion the Union "does not adequately uphold the honour and interests of marine engineers," while he, in making that statement, was aware that more than 1,000 engineers had publicly expressed their opinion that it does, by becoming members of it.

I trust my brethren will appreciate the compliment he pays to their intelligence by setting up his own solitary opinion as superior to their collective wisdom. That his knowledge of marine engineers and their requirements is commensurate with his modesty is amply demonstrated in his proposition that an institution should be founded *on the lines of the N.A. and M.E. societies.*

Ye gods! and little fishes! just fancy two or three hundred sea-going engineers leaving their ships and gallivanting round the country in a body, visiting the various engine-shops for the purpose of learning something about the construction of the very engines they have built, and, it may be, driven for years! The idea is certainly a rich one, but it has *one* recommendation at least, if no more, and that is, it has given rise to much mirth amongst our members; and I hope, for their sakes, your correspondent will carry out his intention of writing further upon the same subject, as I am quite sure his contributions will still further add to their amusement. His assurance that he has no personal animus to myself is quite immaterial, as all the animus he and his friends can raise against me, multiplied by a thousand, if they like, will not in the least daunt or deter me from pursuing the course I have entered upon in endeavouring to raise the status of our profession. He is good enough to credit me with writing twenty-seven lines of "vituperation." I have shown the lines complained of to several gentlemen of education who *know* the meaning of the word, and as they assure me they cannot find anything vituperative in any of them, that confirms my previous opinion that your correspondent must be suffering from "vituperation" on the brain, as it is to be presumed that a member of *two* learned societies must be a man of sufficient education to enable him to understand the meaning of such words. He is therefore more an object of commiseration than censure. I pass over his comments about "polished in style," "effusiveness," &c., as they are unworthy of reply.

I have no hesitation in saying that I am more proud of the "official title," at which he sneers, than if it had been an earldom, as it was bestowed upon me by my brother members as a mark of their confidence and respect; and I will endeavour to prove by my actions that I am not unworthy of the confidence they have so generously reposed in me. Your correspondent's knowledge of the art of advertising is about as limited as it could possibly be, for he asserts that the 26,000 circulars of the Union formed a very effectual means of advertising my own business. These circulars give my name and the street number of the building in which the offices of the Union are located, but there is nothing in them to enlighten the general public as to whether I am an enterprising vendor of real Stilton at 4d. per lb. or a contractor for the supply of tourists' Tweed suits at 23s. 11d. each. If this is really the extent of your correspondent's knowledge of

advertising, I do not think he will ever be as successful as the late lamented Professor Holloway, in amassing a colossal fortune by the aid of advertising.

I have my faults, like all other men, but I am never above taking advice, and when your correspondent can show that he knows more about marine engineers and their requirements than I do myself, I will be very pleased to sit at his feet and humbly and gratefully listen to the sage advice of my newly-found guide and counsellor and friend (?).

Until then I fear I must deny myself the honour of listening further to his wonderful admonitions.

Our brethren in Hull had a very interesting meeting on the 13th of this month, being the occasion of the formal opening of their branch of the Union, and it is very satisfactory to be able to bear testimony to the great enthusiasm prevailing amongst them upon a subject in which all marine engineers are so deeply interested.

Very commodious central premises, containing five rooms, have been secured for the accommodation of the branch, so that members visiting that port will find a most comfortable suite of rooms, as well as a hearty welcome accorded to them, by the local committee and members of the branch.

I remarked in my last that the progress of the Union had been much greater of late than at any previous part of its existence. It is with pleasure I now announce that the membership, which was 1,240 at the date of my last letter, has now increased to 1,480, or an addition of 240 members during the month.

The General Council, of deputations from all the branches, meets in London during the first week in March, and it is quite upon the cards that there may be important changes made in the conditions of membership. Engineers who are making up their minds to become members would, perhaps, act wisely in joining before that time.

With many thanks for your continued courtesy,

I remain,

Yours very truly,

THE HONORARY CHIEF SECRETARY,
MARINE ENGINEERS UNION.

CHIEF OFFICES, 91, MINORIES, LONDON, E.,
24th January, 1888.

THE POSITION OF MARINE ENGINEERS.

To the Editor of THE MARINE ENGINEER.

SIR,—I am many miles from England, and, as a matter of course, I do not get your paper until many days have passed publication; but this very sore point of "Marine Engineers' Position" has interested me for some time, and I am longing to see what results can be gathered from this great institution, which is now pushing itself forward in your midst. I sincerely trust it may succeed. But unless something is done for marine engineers away from Great Britain, as well as at home, I am afraid it will not reap the success it deserves. It is when men are in foreign countries they need a house or club to spend their time when in port (for in these countries any ordinary clerk can join the club of the port, but no marine engineer, even the chief). In Shanghai there is a good club, and it is a credit to the whole world, but unless this new Marine Engineers' Union can be made to spread its wings and fly abroad—to Bombay, Calcutta, Hong Kong, and Yokohama—where there are good men and true, who, I know, would willingly join, it cannot prove of any good to us. But in my own opinion, no amount of writing about mates and engineers can alter our position. We are what we make ourselves. I am only a young man, but I have worked my way from the bottom to be chief in the first company of the world, and I can but say, let the mates look after their department, and let the engineers look after theirs. There is plenty for all; and if engineers as a body would only think and act as they like to talk in mess rooms, I am sure there would not be half the writing and arguing now going on in our papers, and we should all have our own positions. Let us, before we talk of learning navigation and other deck duties, be thoroughly conversant with our own department (and I am sure we have enough without troubling about topsail duties). Let the chief be on good terms with his juniors, no matter how many there may be, for we have all been juniors, and some of us not many days ago, and I am confident, without legislation or compulsory measures, marine engineers will hold their own way both in society and everyday life as well as other departments of the ship. But it all rests with ourselves. I could write many pages on this subject, for it is one of my sore places (engineers *versus* mates), and I delight in reading all your letters and articles on this point; but I cannot as yet see any good coming. Engineers are engineers, and mates are mates, and so the world goes round; but unless the Marine Engineers' Union can extend its wings to foreign countries I cannot as yet see the use of it. Let engineers be engineers and mates mates, and every department for its own interest, and keep confident, whenever we are properly attacked, we shall always find good men and true who can and will fight for us, although we may be classed amongst the unwashed and unclean.

I remain,

Yours faithfully,

OHIO.

NAGASUKI, JAPAN,
November 29th, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—I am watching the development of the M.E. Union with some interest. Since my last letter I note that the membership has increased considerably, but I am still doubtful if the association is likely to meet the long felt want. It seems to me that the founders have only looked at one side of this question. There is no doubt that its aims are aggressive, and owners will not submit to dictation unless compelled to. To assert the rights, redress the wrongs, obtain proper remuneration for the members, this is a "consummation devoutly to be wished." Its founders mean well, but owners will always fight shy in employing men that are not free agents. I believe there are more good ships than good engineers and captains. If the Union had been founded solely to improve engineers in their profession, having meetings and papers read by members, something after the I.N.A., it would have drawn together the best men in the service; besides, young men of ambition would be glad to become members, and they would always have a preference over their less fortunate brethren that were not members.

With reference to the position of engineers at sea, a good man can nearly always command the respect that is his due by his own force of character and conduct without any outside efforts.

It will, no doubt, be too late to carry out any scheme of this nature, but something like the above is wanted, and not simply a trades union, which in time is sure to develop some of the questionable traits which have brought them and their leaders to grief.

Yours faithfully,

S.

January 7th, 1887.

To the Editor of THE MARINE ENGINEER.

SIR,—A copy of your November issue has just fallen into my hands, and through it I received the first intimation of the discussion that is being carried on relative to the Marine Engineers' Union.

The Union was first brought to my notice a few weeks ago, and on perusal of the prospectus I promptly gave in an application for membership, having long been conscious of the necessity of having a well-conducted and powerful association devoted entirely to the interests of marine engineers, before any advancement of their position, or the fair recognition of their arduous services could be looked for.

Now, Sir, if you will do me the honour to insert this in your valuable publication, I should like to offer a few friendly criticisms; for the ultimate success of the Union and the measure of support that it will receive from the most intelligent men in the profession depends entirely on the basis on which it is worked. Judging from the prospectus, the Union will embrace all classes of marine engineers, and in course of time will be able to forward their several interests to the greatest advantage of all. But as I am entirely without knowledge of the management, I hope to be pardoned asking the following questions:—Do they really represent all classes of marine engineers, viz., from first-class passenger and mail lines, first-class cargo lines, coasters, steam colliers, ocean tramps, and others? If not, there will be no unity.

A straw will sometimes show which way the wind blows, and the rule with regard to "unemployed members" has slightly the appearance of the cloven hoof. It has been explained to me as follows:—If a member is in the habit of taking a drop of drink,

and a superintendent asks another member if he has any knowledge of said member's fitness for a situation, he is not to split, "you know." In whose favour, then, is the Union to be run—for drunken loafers and men without either ability or intelligence, or for the sober, hardworking, and intelligent man, who seeks not only his own but his neighbour's advancement? In my opinion the former ought to be discountenanced by the whole weight of the Society's disapproval, forfeiting membership at the second offence, so that owners and superintendents would find it to their advantage to trust the recommendation of the Union's committee in preference even to their own judgment. Is the Union to be used as a strike machine? If so, failure is inevitable; wages must come to market level, whatever that may be, at any given time or place. The success of the Union on its legitimate lines, viz, the increased value of the engineer, is the only sure way of raising salaries, and any attempt at levelling up, protecting intemperate and incapable members, will not only have the opposite effect, but will discredit the whole profession. It is with great diffidence that I would now offer a few suggestions on the lines to be followed.

We do not require an institution on the lines of the I.M.E., for that corporation is already open to all who consider it worth their while joining, or who have leisure on shore to attend lectures, &c., as so few have.

We want a powerful and united society to protect and advance all members of our profession: strong, not to fight owners, but that the Union's representations may have such force and weight as to prove to owners that it is their best policy to concede a gracious consent to the unanimous wishes of their most numerous and valuable servants; to represent to the Board of Trade the numerous incompetent engineers, certificated and otherwise, now afloat, who have obtained their certificates, either by deliberate fraud or on the strength of testimonials from village blacksmiths, friends, or other unauthorized persons, to whom they are represented as having served their apprenticeship; that all engineers afloat, no matter in what kind of craft, should possess certificates; that all engineers desiring to go afloat should first pass an examination, say, equivalent to the present second's examination, after a rigid inquiry into their apprenticeship and competency, not allowing a mere dawdling five years in works or office to suffice, but a thorough training in the shops; to extend the time at which certificates are granted, say to two years for second and four for chief; to raise the standard of subjects and knowledge required at the examinations, more especially the practical knowledge, for it really is pitiful to see candidates for chief's certificate, sitting day after day, while the action of a circulating pump is driven into them, by a person without an atom of practical experience, however clever he may be as a lecturer. These woebegone creatures are never happy till they can repeat their coach's explanation by rote like a parrot, and yet after two or three failures usually become the most swaggering of chiefs; to prevent men entering service at sea, by favour or bribery, as third engineer, and being pushed ahead of men entering as fifth or sixth, who have, may be, been at sea some years, and are infinitely superior and more experienced men; to urge the Board of Trade to use their influence with owners to prevent the appointment of superintendents who do not hold chief's certificates, and are consequently totally unfit to decide the many important questions that daily come up for decision, and are completely ignorant of the hardships and grievances of an engineer's life at sea.

Engineers would also do well to reserve at least one of the higher posts in their works for a chief, for while willingly testifying to the great ability of many managers and draughtsmen, their designs are often spoilt for the want of practical knowledge, and improvement is retarded by the disdain with which the ideas of the practical man are usually treated. To call their attention to the serious undermanning of the engine room staff, and to urge owners to provide better accommodation, and to fit bathrooms to all ships making more than a week's continuous run; to prevent captains from making coal, store, or repair contracts, thereby saving the large commission always demanded by captains to the prejudice of the engineer's department in general, and make the annual engine-room expenditure appear so much greater than it really is; to put it out of the power of captains and stewards to purloin the engineers' food and other necessaries, allowed by the owners, for the benefit of their own pockets, or to take the engineers' steward to wait on captain and mates, while the engineers are left to do the best they can; to assert the engineers' right to promenade any part of the ship except that actually in use for the purposes of navigation.

Uniform is an open question. I am rather an advocate of it, when all parties respect it, and the discipline is thoroughly carried out fore and aft; but let it be neat and gentlemanly. To be put into a flaming brass binding, just to gratify the vanity of an ignorant and arrogant skipper, cannot be too vigorously resisted. As for "puir Jock," I cannot sympathise with him, for if he has not sufficient dignity to defend himself from personal slight, he is occupying a position as chief engineer which he is totally unqualified to hold.

Many of the grievances under which engineers suffer are unknown, or at least have not the approval of the owner; but he finds it easier to replace the complaining engineer than to stir up that hornet's nest, the captain's clique. This is where the support of the Union would be felt, to thoroughly investigate reported cases, and to obtain equal justice for the fifth engineer as for the almighty captain. There would be no occasion for falling foul of the deck hands, if owners would issue distinct printed orders that all their officers were equal in social rank and privileges and regulations as to daily routine, food, &c., and frown more sternly on snobbery, peculation, and fraud, by whomsoever committed.

Books, papers, and instruction, if possible, ought to be provided at all the club-houses, and the latest scientific information, practical and theoretical, ought to be circulated from the head office, so that an engineer in port could spend an hour or two each evening without grudging at his club, out of those short and precious hours which he can devote to his wife and family, knowing that it is for his own improvement, and consequently their benefit.

I trust our worthy secretary will not place himself in a position of antagonism to the deck hands, and thereby make matters worse; but let us one and all show by our conduct what I believe to be actually the case, viz., that there is no ill feeling on our side, and while upholding our rights in a quiet and dignified manner and resisting encroachment, let us hold out the hand of good fellowship to our shipmates, and treat all snobbery, from which ever side it emanates, with the silent contempt that it deserves.

Trusting that nothing that I have said will give offence to any member, as I have only the true interests of our profession at heart, and thanking you for your courtesy,

I remain, Sir,
Yours truly,
PROGRESS.

CONSTANTINOPLE, *December 17th*, 1887.

A NEW DEPARTURE IN BRAZING AND WELDING.

To the Editor of THE MARINE ENGINEER.

SIR,—The cheapening of oxygen by Brin's process of manufacture has put into the hands of metal workers a new power. I have recently made a few experiments with the compressed oxygen and coal gas, and found that with a ½ in. gas supply a joint could be brazed in a 2 in. wrought iron pipe in about one minute, the heat being very short, the redness not extending over 1 in. on each side of the joint.

The appearance of the surface after brazing led me to experiment further with welding, a process which is not possible with ordinary coal gas and air, owing to the formation of magnetic oxide on the surfaces. Contrary to my expectation a good weld was obtained, on an iron wire ⅜ in. diameter, with a very small blowpipe, having an air jet about $\frac{1}{32}$ in. diameter. This matter requires to be taken up and tried on a large scale for such work as welding boiler plates, which, it appears to me, can be done perfectly with far less trouble than would be required to braze an ordinary joint. The great advantage of this would be that the boilers would require no handling, but could be welded with an ordinary large blow pipe in position, and with about one-tenth the labour at present necessary.

The cost of the oxygen is trifling, and it is evident from the results obtained in brazing that the consumption of gas would be considerably less than one-fourth that necessary with an air blast, irrespective of the fact that welding is possible with an oxygen blast, whereas it is not possible if air is used.

The surface of iron heated to welding heat by this means comes out singularly clean and free from scale, and a small bottle of compressed oxygen, with a blowpipe and a moderate gas supply, would make the repairs of machinery, boilers, brewing coppers, and other unwieldy apparatus a very simple matter. The trouble

and difficulty of making good boiler crowns, which so frequently "come down," would be very small indeed, when the workman has an unlimited source of heat at command, under perfect and instant control.

THOMAS FLETCHER.

WARRINGTON, *January 17th*, 1888.

MEAN PRESSURE OF A COMPOUND ENGINE.

To the Editor of THE MARINE ENGINEER.

Sir,—Since I sent you my last statement on the subject of finding the actual mean pressure as found per indicator diagrams in the cylinders of compound engines, I have, from being in possession of some of the main particulars of two well-known crack vessels built and engined on the Clyde, and a third built and engined by a well-known firm on the lower reaches of the Clyde, for the purpose of showing the correctness of the method and how it may be applied in different cases, worked carefully out the following statements. I must mention, that in the first two cases, I do not know what was the actual setting of the slide valves, but, from knowing the H.P. developed, I can come very near it. I have at any rate arranged the cut off in both H. and L.P. cylinders, to give out I may say, the greatest H.P. considerate with good working. So to proceed. The boiler pressure is 90 lbs. or 105 lbs. absolute; the cut off in H.P. cylinder is to be 1·4, and cut off in L.P. cylinder 1·69 or ·56 of stroke, the stroke being 6 ft. and revolutions per minute 64, and taking the clearance in the cylinders at $\frac{1}{17}$ their net capacity, the ratio of cylinders 3·58 and allowing 3 lbs. for loss of pressure between boilers and admission to H.P. cylinder. Then to find receiver pressure,

$$1\cdot4 \cdot \frac{1+\cdot06}{1+1\cdot4\times\cdot06} = 1\cdot36$$

$$\frac{105 \text{ lbs.}}{1\cdot36} \times \frac{1}{3\cdot58\times\cdot59} \text{ or } 77\cdot2 \times \cdot47 = 36\cdot28 \times \cdot83 = 30\cdot11 \text{ lbs.}$$

receiver pressure.

Now to find mean pressure in H.P. cylinder.

$$\frac{1+\text{hyp. log. } 1\cdot4}{1\cdot4} = \cdot954$$

·954 × 105 lbs. = 100·17 lbs. — (3 + 30·11) = 67·06 × ·84 = 56·33 lbs. mean effective pressure in H.P. cylinder.

Now to find mean pressure in L.P. cylinder. 1 + hyp. log. 1·69 = 1·5247 × 30·11 lbs. = 45·098 + 2·75 constant = 16·69 lbs. mean effective pressure in L.P. cylinder.

Now the mean pressure referred to one cylinder will be 16·69 lbs. $+ \frac{56\cdot33}{3\cdot58} = 32\cdot42$ lbs.

Now supposing this vessel is to steam 16·69 knots per hour at sea, what H.P. will be required to give out this speed, her length between perpendiculars being 470 ft., breadth of beam 57 ft. 2 in., and depth moulded 37 ft. 2 in. on a load draft of say 29 ft., the allowance for slip is 15 per cent.

Then

$$\frac{16\cdot69^3 \times 470 \times (57\cdot16 + 58 \text{ two drafts}) \times \cdot78}{20000} = 9813\cdot7 \text{ H.P.}$$

Now to find area of cylinders to give out this power effectively, we have

$$\frac{9813\cdot7 \times 33000}{32\cdot42 \text{ lbs.} \times 768 \text{ ft. per min.}} = 13006\cdot86 \text{ area of L.P. cylinder;}$$

13006·86 + 3·58 ratio = 3633·2 „ H.P. „

or area of two L.P. cylinders 6503·43 each, or two L.P. cylinders 91 in. in diameter, and one H.P. cylinder 68 in. in diameter. Now that we have fixed on the area of cylinders, we can calculate the H.P. from the mean pressure and the travel in feet per minute, or revolutions 64 × 12 ft. = 768 ft. The area of two L.P. cylinders, 91 in. in diameter is 13007·7948, and the area of one H.P. cylinder, 68 in. in diameter, is 3631·6896. So area

$$\frac{13007\cdot7948 \times 16\cdot69 \text{ lbs.} \times 64 \times 12 \text{ ft.}}{33000} = 5052\cdot51 \text{ H.P. L.P.}$$

cylinder. Area

$$\frac{3631\cdot6896 \times 56\cdot33 \text{ lbs.} \times 64 \times 12 \text{ ft.}}{33000} = 4760\cdot97 \text{ H.P., H.P.}$$

cylinder. 5052·51 + 4760·97 = 9813·48 H.P. combined, which is nearly the same as found above, thus showing that cylinders of the above dimensions are large enough to give out the required power with a boiler pressure of 90 lbs. and the slide valves arranged to cut off steam as already stated. I may here state that this vessel, which is a vessel of fine lines, and a mail steamer, averaged 17 knots per hour on her best voyage between Liverpool and New York, so that there is no getting out of this fact.

Case 2nd.—The boiler pressure is 100 lbs. or 115 lbs. absolute, the cut off as arranged is 1·6 in H.P. cylinder and 1·72 in L.P. cylinder, or ·58 of stroke, the stroke being 5 ft. 6 in., the ratio of cylinders 4·21, the clearance $\frac{1}{16}$, and revolutions per minute 64.

$$1\cdot6 \, \frac{1+\cdot062}{1+1\cdot6\times\cdot062} = 1\cdot54$$

$$\frac{115}{1\cdot54} \times \frac{1}{4\cdot21\times\cdot58} \text{ or } 74\cdot67 \times \cdot409 = 30\cdot54 \times \cdot87 = 26\cdot56 \text{ lbs.}$$

receiver pressure.

$$\frac{1+\text{hyp. log. } 1\cdot6}{1\cdot6} = \cdot918$$

·918 × 115 lbs. = 105·57 lbs. — (3 + 26·56) = 76·01 × ·84 = 63·84 lbs. mean effective pressure in H.P. cylinder.

1 + hyp. log 1·72 = 1·542 × 26·56 lbs. = 40·95 + 2·75 = 14·89 lbs. mean effective pressure in L.P. cylinder. Now, supposing this vessel is to steam 16·66 knots per hour at sea, length between perpendiculars 430 ft., breadth of beam 50 ft., depth moulded 33 ft., on a draft of say 27·5 ft.

$$\text{Then } \frac{16\cdot66^3 \times 430 \times (50 + 55 \text{ two drafts}) \times 78}{20000} = 8142\cdot304 \text{ H.P.}$$

Now, to find area of L.P. cylinder, we have 14·89 lbs. $+ \frac{63\cdot84}{4\cdot21} = 30\cdot05$ lbs. Then

$$\frac{8142 \times 304 \times 33000}{30\cdot05 \text{ lbs.} \times 704 \text{ ft.}} = 12701\cdot18 \text{ area of L.P. cylinder,}$$

12701·18 + 4·21 ratio = 3016·9 „ H.P. „

or two L.P. cylinders 90 in. in diameter, and one H.P. cylinder 62 in. in diameter. Now to find H.P. from diameter of cylinders.

Area

$$\frac{12723\cdot48 \times 14\cdot89 \text{ lbs.} \times 64 \times 11 \text{ ft.}}{33000} = 4041\cdot65 \text{ H.P., L.P. cylinder.}$$

Area

$$\frac{3019\cdot0776 \times 63\cdot84 \text{ lbs.} \times 64 \times 11 \text{ ft.}}{33000} = 4111\cdot74 \text{ „ H.P. „}$$

4041·65 + 4111·74 = 8153·39 H.P. combined, thus showing that the cylinders are large enough to give out the required power. Now this vessel deeply laden or with 1,300 tons less than her register tonnage on board, it being 4,300 tons, steamed on trial 18·18 knots per hour, but it was allowed that fully a knot was due to her propeller which was made of manganese bronze, its diameter being 24 ft. 4 in., and pitch 31 ft., revolutions on trial 66½ per minute. I have allowed 14·9 per cent. slip, so that this vessel could steam 17 knots per hour steadily at load draft.

Case 3rd.—Boiler pressure 60 lbs. or 75 lbs. absolute; cut off in H.P. cylinder is 1·34 and L.P. cylinder 1·53 or ·65 of stroke, the stroke being 4 ft. and revolutions per minute 65, taking clearance at $\frac{1}{12}$ the net capacity of cylinders, the ratio of cylinders being 2·918.

$$1\cdot34 \, \frac{1+\cdot083}{1+1\cdot34\times\cdot083} = 1\cdot3$$

$$\frac{75 \text{ lbs.}}{1\cdot3} \times \frac{1}{2\cdot918\times\cdot65} \text{ or } 57\cdot69 \times \cdot527 = 30\cdot4 \times \cdot83 = 25\cdot23 \text{ lbs.}$$

receiver pressure.

$$\frac{1+\text{hyp. log } 1\cdot34}{1\cdot34} = \cdot964.$$

·964 × 75 lbs. = 72·3—(3 + 25·23) = 44·07 × ·84 = 37·01 lbs. mean effective pressure in H.P. cylinder.

1 + hyp. log 1·53 = 1·4252 × 25·23 lbs. = 35·957 + 2·75 = 13·07 lbs. mean effective pressure in L.P. cylinder.

$$13\cdot07 \text{ lbs.} + \frac{37\cdot018}{2\cdot918} = 25\cdot75 \text{ lbs. mean, referred to one cylinder.}$$

The dimensions of this vessel, which be it observed is a finely shaped vessel, is length between perpendiculars 362·2 ft., breadth 37·25 ft. and load draft 23·5 ft., and she is to steam 12 knots per hour at sea. What H.P. is necessary to give out that speed? The factor in this case is ·813, allowance for slip being 15 per cent.

Then

$$\frac{12^3 \times 362\cdot2 \times (37\cdot25 + 47 \text{ two drafts}) \times \cdot813}{20000} = 2143\cdot495 \text{ H.P.}$$

Supposing the H.P. was assumed, the question in order to find speed would become

$$\frac{\text{H.P. } 2143\cdot495 \times 20000}{362\cdot2 \times (37\cdot25 + 47) \times \cdot813} = 1728$$

$$\sqrt[3]{1728} = 12 \text{ knots per hour.}$$

Now to find area of cylinders to give out this power effectively, the ratio of cylinders being 2·918 and the speed of piston 520 ft. per minute. Then

$$\frac{2143\cdot495 \times 33000}{25\cdot75 \text{ lbs.} \times 520 \text{ ft.}} = 5282\cdot69 \text{ area of L.P. cylinder.}$$

$$5282\cdot69 \div 2\cdot918 \text{ ratio} = 1810\cdot38 \quad ,, \quad \text{H.P.} \quad ,,$$

or, L.P. cylinder 82 in. in diameter, and H.P. cylinder 48 in. in diameter. The capacity of cylinders is sufficient for the required power. As I have sailed in this vessel for over a year and six months, further comment is unnecessary.

I may also add the results of a modern torpedo boat on trial. Length between perpendiculars 110 ft., breadth of beam 12 ft., and draft 6 ft. $2\frac{1}{2}$ in., H.P. developed 698·25, factor for torpedo boats ·57 to ·58. Then to find speed per hour.

$$\frac{698\cdot25 \times 20000}{110 \times (12 + 12\cdot5 \text{ two drafts}) \times \cdot58} = 8934\cdot173$$

$$\sqrt[3]{8934\cdot173} = 20\tfrac{3}{4} \text{ knots per hour.}$$

D. McMILLAN.

November 2nd, 1887. s.s. *Merkaru.*

Miscellaneous.

An Exceptional Voyage of a Torpedo Boat.—Advice has just been received of the safe arrival at Guayaquil of a torpedo boat lately completed by Messrs Yarrow & Co. for the Republic of Ecuador, a distance of 10,670 miles. Advice has also been received of the safe arrival at Hong Kong of the torpedo boat lately built by the same firm for the Chinese Government. These two voyages serve as an additional proof of the thorough sea-going qualities of vessels of this class.

The Oldest Steamship in the Navy.—The *Wildfire*, 186 tons, 198 H.P., which has been employed for many years past as tender to the *Duncan*, flagship of the Commander-in-Chief at the Nore, has been condemned as unfit for further service. The *Wildfire* is the oldest steam vessel in the Royal Navy, having been built in the year 1826, at a cost of £9,658. She has been continuously employed upon active service from the time she was built, and during the earlier part of her career she used to carry the mails between Dover and Calais. The next steam vessel in age to the *Wildfire* is the *Harpy*—tender to the *Royal Adelaide* at Plymouth—which was built twenty years later, at a cost of £17,193, but the latter is an iron vessel, while the *Wildfire* is built of wood. The Admiralty have invited tenders for a new screw yacht to take the place of the *Wildfire* at Sheerness.

Fast Ocean Steaming.—The Orient Line steamship *Ormuz* arrived in Plymouth Sound at 6.30 p.m. on January 14th, it being but the ninety-first day since she sailed from that port to the colonies. In the interval she had travelled 24,060 knots, and made fifteen stoppages at various ports of call, besides remaining fifteen days at Sydney, the colonial terminus of the Orient Line. The *Ormuz's* outward passage is distinguished by being the fastest ever made to the antipodes, her ocean steaming time from Plymouth to King George's Sound being 25 days 6 hours, and the time occupied in the transit of the mails to that port from the hour of posting in London being 23 days 16 hours; a remarkable record, notwithstanding the fact that, with the exception of two days, strong head winds and seas were experienced all the way from Aden. The speed averaged from the time of taking the mails on board at Suez till landing them at Adelaide was upwards of $15\frac{3}{4}$ knots, and the best day's run was 420 knots, equal to $17\frac{1}{2}$ knots. The *Ormuz* has come from Adelaide under easy steam in less than 33 days, including all stoppages, her steaming time being about 30 days port to port, showing an average speed of over 14 knots.

Swift Powerful Sloop of a New Type.—Mr. W. H. White, Assistant-Controller of the Navy and Director of Naval Construction, has designed a swift powerful sloop of a new type, which is to be built at Sheerness Dockyard. The vessel is to be 220 ft. between perpendiculars, and 233 ft. "over all," with a breadth of 35 ft. She will have a displacement of 1,580 tons, and will be by far the largest sloop ever built for the British Navy. She is to be fitted with sponson ports forward and aft, upon which will be mounted four 36 pounder quick-firing guns. She will also carry two 36-pounder guns amidships. Four 3-pounder quick-firing guns are to be mounted on her main deck under the forecastle and poop. Torpedo tubes are to be fitted for the first time in a sloop, it having been decided to equip her with two 14 in. revolving and two fixed tubes for discharging Whitehead torpedoes. She will also be the first sloop to be built of steel, the sloops at present in course of construction being built of wood with steel frames. She will be unarmoured, but her vital parts will be protected by a steel deck extending the entire length of the ship. It is estimated that the vessel will have a speed of 20 knots.

Mr. W. B. Thompson, of the Caledonian Shipyard, Dundee, has patented a channel coast indicator for use in fogs. This invention is intended to prevent the recurrence of such an accident as the loss of the channel steamer *Victoria*, which, it will be remembered, was recently lost on the French coast, some fourteen miles out of her course, on a voyage from Newhaven to Dieppe, during the prevalence of a dense fog. Mr. Thompson proposes that two light but strong cables shall be laid along the sea bottom from harbour to harbour, and along these wire ropes a small brass traveller is to be drawn by the steamer, to which it is connected by the smaller wire secured at its lower end to the traveller, while the other end is made fast on board the steamer. The method of using the apparatus is as follows:—The wire connecting the steamer to the traveller is made fast at the stern, and the steamer leaves harbour. A seaman stationed at the stern watches the direction of the wire, and as long as it descends into the water in a direct line aft, the vessel is on her course, but should she deviate a point or two, the fact is at once apparent to the lookout at the stern, who notifies the steersman as to the direction in which the vessel is going out of her course, and a few turns of the steering wheel at once corrects the deviation and brings the vessel on her true course.

An Ice Crushing Vessel.—Quite a remarkable boat is soon to be turned out at the docks of the Detroit Dry Dock Company. It is built for the Mackinac Transportation Company, and is to be used as a car ferry boat. The boat is 235 ft. long, 52 ft. broad, and 25 ft. deep, and will be able to carry ten freight cars, or eight passenger cars. It is, however, as an ice-crushing machine that the new boat is expected to be remarkable, and her construction is such that it will be impossible for soft ice to cling to her sides. The propelling power is furnished by a compound engine of 2,000 H.P., with $28\frac{1}{2}$ in. and 53 in. cylinders, having a 48 in. stroke, and driving a 12 ft. wheel. In addition to this there is another and smaller engine of about half the power, whose chief object is to serve as an ice breaker. It has been found that the easiest and quickest way to get ice out of a slip is to back the boat into the ice, hold her there with lines, and then by working the engine forward throw a column of water under the ice, which never fails to break it up and drive it out of the slip. This fact suggested the peculiar feature of the new boat—her two wheels. "No. 85," as the new ferry is known on the company's books, will go in the ice bows on, and while held there by her large propeller, the smaller wheel—itself 10 ft. in diameter—will clear the way into the ice. The top of the buckets of this wheel will be 6 ft. under the surface of the water, so that there will be no danger of its being broken by the ice. There are three double-ended boilers, 18 ft. long by 11 ft. 6 in. diameter, equivalent to six ordinary boilers. They are placed side by side, and have two smokestacks, one forward of the other, ocean style. Her bow is so constructed as to stand the severest shocks, and her hull is sheathed with steel plates $\frac{1}{2}$ in. in thickness. Naturally requiring great steering power, a special steam steering engine has been designed for her by the Manton Steam Windlass Works, of Providence, R.I. To prevent her rolling in heavy seas, two tanks, holding about 25 tons of water each, have been placed athwartship. An electric light of 2,000 candle-light power will be fastened to her pilot house. It is expected that she will go up to Mackinac this winter to try her powers in the ice. The results of her trial trip will be looked for with much interest. Mr. Frank E. Kirby, of Detroit, is her designer.—*American Engineer.*

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from December 16th, 1887, to January 12th, 1888.

17310 Edmund Walsh. Signalling at sea.
17314 W. Alexander. Paddle wheels.
17319 W. L. Byers & J. B. Storey. Anchors.
17418 J. M. Stratton. Steam boilers.
17421 J. Broadfoot. Ships' ventilators.
17471 G. A. Moore. Loading and unloading ships.
17560 T. Pease. Signalling at sea.
17567 Budenberg (Schaffer and Budenberg). Centrifugal governors.
17607 M. Immisch. Propulsion of vessels.
17663 T. F. Matthews & J. Johnston. Level governor for marine engines.
17668 A. Stewart. Camp stools and chairs for use on shipboard.
17692 Newton (E. T. Starr). Anchors.
17722 J. S. Gisborne. Signalling on ships.
17747 S. Saunders. Tubular boilers.
17752 E. Davies. Compound engines.
17769 F. Trollope. Ships' side table.
17787 C. H. Hedderly, W. G. Clark & J. Judge. Oil feeder.
17790 J. Reed. Evaporator for marine boilers.
17818 A. Bradshaw. Return steam traps.
17820 J. Henderson. Paddle wheel feathering gear.
17847 Newton (R. A. Cheesebrough). Propelling steering vessels.
17860 J. Gilmour. Condensing and fresh water supply apparatus for boilers.
17888 G. A. Smith. Electro-magnetic marine governors.
17891 H. Jarman. Revolving multiple cylinder engines.
17903 J. Kirkaldy. Supplying fresh water on ships.
17915 W. Fairweather. Propelling ships or boats.
18000 J. Murrie. Governors for marine engines.
9 E. P. Plenty. Forced draught closed ashpits.
16 Willcox (La Société des Usines Franco-Russes). Propeller and other shaft coupling.
50 D. J. Morgan. Ships' lights.
127 J. Linkleter. Boats.
128 D. Adamson. Steam boilers.
161 F. W. Brewster. Life saving buoys.
164 J. M. B. Baker. Removing bars of sand by action of tide.
167 E. A. Wood. Bow rudder.
172 R. Marth. Collapsible boats.
288 C. Simmons & C. Cravos. Ships' hanks.
304 Boult (W. Meissel). Distributing oil upon water.
316 Stevens (G. T. Stevens). Reefing schooners' sails.
317 D. Powel, Jun. Centreboard countervail.
320 A. Palfroy. Sails for yachts.
340 F. D. Taylor. Anchors.
344 J. Nixen. Anchors.
351 T. Hitt. Anchoring vessels in a storm.
352 G. Drake. Raising sunken vessels.
362 T. L. D. Broughton. Indicating the rule of the road at sea.
374 J. Willis. Steam wheels to propel ships, &c.
408 J. H. Laidman. Stern posts.
464 J. Allen. Construction and propulsion of lifeboats.
474 T. W. Scott. Vessels propelled by screws.
527 Gray (— Wicks). Ships' davits.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

December 31st, 1887. Hawthorne, J. G. Extra 1 C.E. Hull.

Note.—E 1 C denotes Extra First Class; 1 C, First Class; 2 C, Second Class.

December 24th, 1887.

Atkinson, Wm....	1C	Liverpool
Bach, Francis G.	2C	Cardiff
Bailey, Wm. J....	1C	,,
Ballantine, John	1C	Glasgow
Bell, Anthony P.	2C	Liverpool
Brewer, Joseph...	2C	Cardiff
Buchanan, R. D.	2C	Glasgow
Burss, G. C.	1C	Dundee
Campbell, John D	2C	Glasgow
Carruthers, James	2C	Liverpool
Christie, John W.	2C	N.Shields
Crerar, Wm.	2C	Glasgow
Daniel, Fred. G.	2C	Cardiff
Davey, John	1C	Plymouth
Donbavard, C. J.	1C	London
Downie, T. G. R.	1C	N.Shields
Evans, Daniel ..	1C	Cardiff
Fraser, James ..	2C	,,
Havllar, Saml. P.	2C	N.Shields
Hunter, James ..	2C	,,
Jones, Wm.	2C	Cardiff
Lee, Robt. Evans	1C	,,
Mitchell, Wm. ..	1C	,,
Morgan, Robt. ..	1C	Liverpool
Nicholson, John	2C	N.Shields
Parry, Owen H.	1C	Liverpool
Peice, Wm. J. ..	2C	Cardiff
Ross, James	2C	N Shields
Rulley, John....	1C	Liverpool
Scouller, Hugh ..	2C	Glasgow
Simpson, John A.	1C	Liverpool
Smith, John	2C	W.H'pool
Sturrock, Geo. A.	1C	Dundee
Taylor, Thos. W.	1C	Liverpool
Thomas, Evan ..	1C	Cardiff
Thomas, George	1C	,,
Willy, Amos	1C	,,
Young, Hugh ...	2C	Glasgow

December 31st, 1887.

Barrasford, Thos.	2C	N.Shields
Brown, Joseph ..	2C	London
Child, Reginald..	2C	,,
Clark, Matthew..	2C	,,
Dale, Wm. S. ..	2C	Sunderl'd
Evans, John W.	2C	London
Gordon, John C.	2C	Aberdeen
Hague, Henry ..	2C	London
Harvey, John W.	2C	Greenock
Hedley, Richard	2C	Sunderl'd
Henderson, Wm.	2C	Aberdeen
Hilling, Frederick	2C	Hull
Kemmet, Thos. S.	1C	N.Shields
Lane, Alfred Wm.	1C	,,
Lister, James R.	2C	Sunderl'd
Lofthouse, Wm...	1C	,,
McAdie, Ralph ..	1C	Aberdeen
McKay, Wm....	2C	N.Shields
Potts, Geo. Wm.	2C	Sunderl'd
Robson, John....	2C	,,
Robson, J. T.....	2C	,,
Sedgwick, W.....	1C	,,
Smith, David L...	2C	Hull
Smith, John	2C	London
Stephenson, J. E.	2C	Hull
Stones, Robert ...	2C	Sunderl'd
Swedberg, C. E...	2C	N.Shields
Taylor, James....	1C	Hull
Trotter, F. Clark	2C	Sunderl'd
Yates, John......	1C	Hull

January 7th, 1888.

Beazley, Ernest ..	1C	London
Davies, Henry H.	2C	Liverpool
Dumbell, John ..	1C	,,
Enchauzier, A. ..	2C	Glasgow
Gordon, Alex......	1C	,,
Guy, William....	1C	,,
Hamilton, Wm...	2C	Liverpool
Hill, Peter O.....	2C	,,
Kurruish, Charles	2C	,,
Lang, J. Samuel	1C	Glasgow
Linchey, Thomas	1C	,,
Marshall, Wm. W.	1C	,,
McKenzie Wm. R.	2C	Liverpool
Mitchell, A.	1C	Glasgow
Parry, Owen H...	1C	Liverpool
Quayle, Charles..	1C	,,
Smart, J. C.	1C	Glasgow
Stewart, John....	2C	London
Sugars, George..	2C	Liverpool
Toddie, William..	1C	Glasgow

January 14th, 1888.

Adams, Duncan ..	1C	N.Shields
Barclay, A. C. ..	2C	London
Bowdier, Wm. ..	1C	W.H'pool
Brackenbury, W.	1C	Hull
Crammond, Wm.	2C	W.H'pool
Davies, Harry H.	2C	Liverpool
Evans, Joseph....	2C	,,
Goodall, Wm. G.	1C	N.Shields
Gore, Robert	1C	Liverpool
Hill, Peter G.....	2C	,,
Holden, John	2C	,,
Kirk, John Wm...	2C	Hull
Shuffle, Charles ..	2C	London
Thomas, John....	1C	,,
Thompson, Thos.	1C	N.Shields
Tweedie, W. C...	2C	Liverpool
Verran, Wm.	1C	N.Shields
Wake, William ..	2C	W.H'pool
Wilson, H. C. ..	2C	London
Wilson, Robert ..	2C	Dublin

January 21st, 1888.

Anderson, Wm. S.	1C	Glasgow
Atkins, Wm.	1C	Cardiff
Bishop, James....	2C	Liverpool
Bishop, Thomas..	2C	Glasgow
Cansick, Wm.....	2C	N.Shields
Clarke, J. B.	1C	London
Clarke, Wm.	2C	,,
Craggs, C. E.....	2C	N.Shields
Dawson, S.	1C	London
Dibbs, W. Cowan	2C	Glasgow
Donald, Geo. G...	2C	London
Drummond, Wm.	2C	London
Edmondson, John	2C	Liverpool
Eldin, George....	2C	Hull
Foxlee, John E...	2C	London
Gregory, Chas. J.	1C	,,
Guthrie, John....	2C	Glasgow
Guthrie, Robert..	1C	London
Holt, Wm. Walter	2C	Cardiff
Hughes, Hugh ..	2C	Liverpool
Hunter, John W.	2C	London
Jackson, John D.	2C	Liverpool
McMillan, M.	1C	Cardiff
McNabb, John G.	1C	Liverpool
Menzies, Alex. ..	1C	Sthmpton
Morrison, Wm. ..	1C	Glasgow
Page, A. B.......	2C	Hull
Pearch, Robt. H.	1C	London
Reid, Peter M. ..	2C	Glasgow
Robertson, J. M.	1C	Liverpool
Scott, James	1C	Glasgow
Shaw, J. Hunter	2C	,,
Smyth, Charles A.	1C	Liverpool
Stanton, Arthur..	2C	London
Strachan, James..	2C	Liverpool
Strong, Robert ..	2C	,,
Thubron, E. B. ..	1C	London
Todd, Robert F...	2C	Glasgow
Trotman, W. H...	2C	Sthmpton
Turner, Robert ..	1C	Cardiff
Waite, George ..	2C	London
Wake, Fredk. W.	2C	,,
Walker, S. H. ..	2C	N.Shields

Admiralty Contract.—The Admiralty have contracted with the Barrow Shipbuilding Company to supply the machinery of the new composite gunboats, *Peacock*, *Pigeon*, and *Rover*. The engines are to be of 1,200 H.P., with which it is expected a speed of 13·5 knots will be obtained. The vessels are to be of 755 tons displacement, and will be armed with steel 4 in. breechloading guns.

The Marine Engineer.

LONDON, MARCH 1, 1888.

EDITORIAL NOTES.

CONSIDERABLE interest has been caused by the issuing of a most powerful association to take over the extensive shipbuilding yards and engine works at Barrow, on what appear to be most favourable terms to the new Company, whose directorate, headed by the Marquis of Hartington, and including Lord Brassey, Admiral Boys, J. Annan Bryce, Esq., Thorsten Nordenfelt, Esq., Archibald Douglas, Esq., form an exceptionally well-known and powerful body of gentlemen. The Barrow yard is well known to be one of the best-arranged ship and engine building works in the kingdom, and only requires good influence for the securing of contracts to turn out an enormous quantity of valuable work per annum. As it is said that the Spanish Government have decided to reconstruct their Navy at a very large expenditure, the new Company has secured, or are in a fair way to secure, a considerable portion at least of the orders from the Spanish Government, and they propose to establish a local branch yard in Spain. The new Company will not confine itself only to ship and engine building, but include armaments in their title and their scope of operations. For the present they have made arrangements with the Nordenfelt Guns and Ammunition Company, Limited, and Sir Joseph Whitworth & Co., Limited, for the supply of small and large arms. The new Company is also evidently going to make a speciality of the new Nordenfelt submerged torpedo-boats, of which two have already been built at Barrow, and which at their trials have attracted so much attention. The combination of this powerful ship and engine building works with two of our most important ordnance manufacturing companies seems to be a clever combination, as by their mutual arrangement the ordnance companies utilising their already well established connections and agents will be able to secure orders for completely armed vessels; and similarly the Barrow works will be able also to take similar orders, including armaments of the latest and most novel character. As things are looking very bright in the shipbuilding trade generally at present, it seems as if this Company is getting in in the first swim of better times; and as it has been the declared policy, latterly, both of Conservative and Liberal Governments, to encourage as far as possible, by the placing of Government orders, private enterprise in the construction of armourclads, torpedo-boats, and ordnance, this Company may no doubt rely upon getting a fair share of such home work. The advantage to the country is obvious, in case of any sudden outbreak of a serious war, to have within its shores as many prosperous ironclad and armament building establishments as possible, in which a prompt and sudden increase of our naval power can be readily obtained. Such works, in fact, form a reserve to the defensive power of the country of very great value, without heavy charge upon the taxpayers.

IN view of such steady development of our manufacturing resources, we do not, as a nation, feel that serious alarm that seems so strongly rooted in the mind of Sir Thomas Symonds, Admiral of the Fleet, that England's navy is totally at present unfit for the requirements which it might be called upon at any moment to fulfil. We have been favoured by Sir Thomas with a long and carefully compiled series of tables giving close comparisons of our navy with those of France, Italy, Germany, and Russia, which from the statements, as compiled in these tables, show that the English armourclad fleet is inferior to that of France, and is therefore totally unfit to contend with any combination that might possibly be brought against us. Sir Thomas considers that although on paper we make a good show in actual numbers, the inferiority of their armament and the drawbacks in their somewhat obsolete method of construction reduces our actual strength very considerably. He also attaches very great importance to the employment throughout the Navy of breechloading guns, of which we have comparatively few in our ironclad navy as yet, we having been the most dilatory of all nations in adopting the breechloading system. The work, then, that Sir Thomas Symonds wants the nation to at once undertake is somewhat gigantic in its character, namely, a complete renewal of what he terms the obsolete muzzle loaders by modern breechloading guns, and a substantial increase of the Navy, to at once place our fleet in a position of supremacy above all other nations, and therefore fairly competent to meet a combination of any two. There is no doubt that our fleet must be looked upon as a form of insurance for the safety of our commerce, and for our very existence as a nation, to maintain our supplies of food; and there can be therefore little difference of opinion as to the necessity of maintaining a more powerful fleet than any other nation, so long as we can find the money to do it with. But where is the limit to this relative game of brag among the civilised nations? We have seen to what an almost unbearable burden the

maintenance of gigantic land armies on the Continent has reached, and the same thing may arise by a competition of nations for the most powerful navy. The French, for instance, vote an extraordinary budget for ironclad construction "to obtain a maritime superiority over all other nations," and if we are to proceed on the same lines, where is to be the end of it all? A general national bankruptcy, or a return to common sense? The French also have lately had a scare as to the fighting strength of their fleet, so that probably we shall now have a fresh spurt on their part, which will again make it equally difficult for us to keep apace or ahead of them. In spite of Sir Thomas Symonds' heavy criticisms, there will always be a lurking feeling in the British mind that even given a certain inferiority in numbers and weapons, as against a combination of any two continental powers, we should always find ourselves, as we have often done before, equal to the emergency, and capable of coming out victors even with the odds against us. It is well, however, for us not to have our eyes shut to facts; and such able criticisms as those of Sir Thomas Symonds are a valuable addition to our naval estimates. It is to be remembered, as a bye point of some value, that no nation in Europe has the same facilities as ourselves for the rapid acquirement of ironclads or ordnance in the course of construction in the various private factories of our country, or for the rapid development of our defensive resources in the same factories, should urgent need show itself. This is a reserve strength of enormous importance, since it costs the nation nothing in time of peace, and it should, in consequence be, carefully fostered by our Government.

THE question of forced draught is still in its infancy. There are two or three engineers, Mr. Howden in particular, whose names have been associated with the development of the application of forced draught to marine boilers, and it is curious to see the contradictory and often violent opinions expressed by those who are either interested in the development of some particular system, and those who, for some reason or other, have taken a prejudice against it. There is no doubt that a good deal of these contradictions may be explained by the fact, that very little is known in actual practice with regard to the best conditions under which forced draught may be employed, and it is obvious that many of the conditions of economy and combustion may be entirely altered from those with which boiler users are familiar by natural draught alone. Hence, though forced draught as a principle may be beneficial, the ignorance of the users as to the most beneficial arrangements may cause trouble and eventual disgust with the whole arrangement, when the drawbacks might have been avoided by greater knowledge and experience. General principles should be kept in mind, that the employment of a forced draught is primarily to increase the combustion of fuel per area of grate in any boiler, above what can be effected by the natural draught, and this temporary increase was first sought merely to be employed in cases of emergency where great evaporation might be a matter of life and death. It by no means follows that great increase of evaporation, so effected, results in economy, but may lead directly to the converse. The spacing of the bars in a grate is of vital importance in determining the proportion of air admitted for the combustion of the fuel and volatile gases; and a spacing that may be suitable for a natural draught would, on the face of it, be unsuitable for forced draught, and *vice versâ,* since maximum economy is effected when there is most perfect combustion of both solid fuel and volatile gases by the admission of a proper proportion of air. Given a grate, then, which has been worked with natural draught, the results, both of evaporation and economy, may be greatly benefited by the employment of a forced draught up to a certain point, beyond which point the economy may fall off; and, though the evaporation may still increase, the straining of seams and burning of fire bars, and other drawbacks of that kind, may go far to discredit the arrangement in the mind of the user. A series of exhaustive experiments as to the most favourable conditions under which forced draught may be applied, would be of extreme value to all interested, or the detailed publication by Mr. Howden or others who have worked for many years in this direction would answer the same purpose, namely, to define with a given grate, given air space, and given natural draught, how far the application of forced draught would combine true economy and greater evaporation, and at what point the greater evaporation would be obtained at the cost of economy. Possibly some of our readers who are in charge of forced draught apparatus might be able to send us, through our correspondence columns, their experiences in these points.

A GOOD deal of attention is now attracted to the rapid development of the ports of Cardiff and Newport, and although their progress has been most marked and rapid, a good deal of exaggeration has been used in the description of their progress. It is gratifying to note that the ports in the Bristol Channel, with the exception of poor Bristol herself, who is now somewhat left out in

the cold, are rapidly pushing their way to fortune. Some 48 years ago, when the Marquis of Bute opened the first dock in Cardiff, the population was but some 10,000 in number, and the town consequently not even tenth-rate in size or importance. Now, with a population of somewhere about 130,000, she can well hold her head up and rejoice in her progress. For shipment of cargo to foreign and colonial parts Cardiff is now very nearly the second port in the kingdom ; but it must be remembered that this is only one branch of trade, and we think a comparison of actual figures will show that more than double the registered tonnage has been cleared from Liverpool, and half as much more from the Tyne, than from Cardiff, whilst London still holds her great pre-eminence, with about three times the tonnage cleared than at Cardiff. In the item of shipment of coal there is little doubt that Cardiff stands pre-eminent in the whole world. However, Cardiff is hardly likely to stand long at her present figures, but to struggle still further to pre-eminence. The Dowlais Iron Works are now building three new furnaces close to the docks, as nearly all ore used by them for steel conversion is imported from Spain. The new dock opened last year has the finest lock, we believe, of any in the kingdom, and the dock itself, 2,400 ft. by 600 ft., affords room for the largest ocean steamers to swing in it, which can be rivalled only, we believe, by the Birkenhead great float. It is said that the Anchor Line is going to make this dock a terminus, and as the sea-route to New York from Cardiff is nearly 100 miles shorter than from Liverpool, and the railway route to London *viâ* the Severn tunnel is 46 miles shorter than from Liverpool, there are great possibilities before Cardiff as a port of departure for passenger traffic to New York.

LIGHTHOUSE ILLUMINANTS.—Mr. John R. Wigham, M.R.I.A., delivered a lecture on this subject on February 9th to the Belfast Natural History and Philosophical Society. The lecture embraced a description of the catoptric and dioptric systems of lighthouse illumination as applied to fixed, intermittent, and flashing lights, and was illustrated by numerous interesting experiments, diagrams, and models. Mr. Wigham exhibited his great gas lighthouse lights in operation, and explained several new inventions of his connected with lighthouse illumination. He explained the construction and great power of a new form of gas light which he had devised, which is capable of transmitting to the mariner a beam twice as powerful as any shown in the South Foreland experiments. He also showed by practical experiments the unsuitability of the electric light for lighthouse illumination, and, on the other hand, quoted the testimony of captains of the great Atlantic liners as to the power, in penetrating fog, of the gaslight recently erected by him on Tory Island, and that the glare of its powerful beam had been observed, indicating the position of the lighthouse, when the light itself was obscured by fog, and in some instances even when it was below the horizon. A plan for supplying lighthouse lamps with air under pressure, called by Mr. Wigham a fourth illuminant, was also shown, by the adoption of which the flame is surrounded by a cylinder of air, and the necessity for the employment of a glass chimney obviated.

FEED HEATERS.

(*Continued from page 376.*)

ALTHOUGH larger boilers are theoretically required in those cases where the feed water is heated by steam, either direct from the boiler or from the I.P. or L.P. receivers of a marine engine, yet this increase is confined only to the water capacity of the boiler. Since all the heat contained in the steam which is employed to raise the temperature of the feed is returned again to the boiler, it is evident that no more heat is required theoretically than if the feed heater were absent; and, therefore, no increase is needed, either in the grate area or heating surface of a boiler, by the application of a feed heater. As was proved in our last issue, that for every 3·4 lbs. of steam utilised in the engine, the boiler must evaporate 4·4 lbs., it therefore follows that a boiler must possess a greater water capacity where associated with a feed heater than where it supplies steam for use in the engines only. As a rule, the power and capacity of the boilers of ships of the merchant navy are so large compared with the actual requirements of the engines, that feed heaters can be applied without any alterations being made to the boilers, and without affecting the supply of steam to the engines. It has already been shown that nearly all the advantages to be derived by the use of feed heaters are of a mechanical nature—the prevention of unequal strains and consequent leakage, of corrosion, and of the deposition of scale and grease on the plates of the boiler. The higher the temperature at which the water can be returned to the boiler, the greater will be the benefits that are gained. In fact, to reap all the advantages accruing from the use of hot feed water, its temperature should not be less than 290 deg., which is the point at which the ordinary sulphates cannot be retained in solution in water, but are precipitated. So far, to judge from the glowing reports that are being constantly received from the engineers of ships fitted with feed heaters, these fittings appear to be giving general satisfaction, even though they be of the types which do not aim at economy of fuel as their *raison d'être*.

In well clothed modern engines and boilers, very little loss of heat occurs, other than in the escaping products of the combustion of the fuel, or in the steam as it escapes in the exhaust. If this latter, say at a temperature of 200 deg., were to be trapped on its way to the condenser, and utilised in warming the feed water, the vacuum or back pressure in the L.P. cylinder would be seriously affected, and the power of the engine diminished. Unless the vacuum were to be wholly sacrificed, the exhaust steam could only impart its heat to the feed in an apparatus similar to a surface condenser, and consequently but very little of the latent heat of this steam would be transferred to the water. Since, for every pound of steam going from the L.P. engine, the same weight of water must pass through the heater to the boiler, it follows that the maximum rise in temperature of the feed would be only 50 deg., supposing the temperature of the hot well to be 100 deg. This is so very slight, either for economy or for producing any other marked advantages, that the cost of the apparatus required and the loss that would arise through the exhaust being choked and the vacuum impaired, would outweigh the benefits derived ; and we therefore find that this plan is never adopted in condensing engines.

Instead of placing the feed heater in the passage of the exhaust steam from the L.P. cylinder to the condenser, some of the specialists in this branch of engineering connect the heater to the receiver between the H.P. and I.P. cylinders. Let us consider how a triple-expansion engine is affected for economy by the addition of a feed heater connected in this way. A pound of steam from the boiler at 160 lbs. pressure expands and does work in the H.P. cylinder until its pressure is only 90 lbs., when it is released and exhausts into the I.P. receiver at a pressure of about 70 lbs. (absolute). If the steam connection to the feed heater be so designed that only just sufficient steam will go to the heater as will raise the temperature of the water to 290 degrees (which is that of steam of 60 lbs. pressure), the effect will be to cause the pressure in I.P. receiver to drop from 70 lbs. to 60 lbs. If x be the fraction of a pound of steam that goes to the heater, then $1-x$ would be the remaining fraction of a pound of steam which would pass at 60 lbs. pressure into the I.P. cylinder be expanded there and do work, being released at say 20 lbs. pressure, and exhausted into the L.P. receiver, where the pressure would drop to about 15 lbs. From the L.P. receiver this $1-x$ part of a pound of steam would go into the L.P. cylinder, and expanding until its pressure fell to 8 lbs., would exhaust at from 2 lbs. to 3 lbs. into the condenser. The total heat in every pound of steam leaving the boiler at 160 lbs. pressure is about 1,120 thermal

units. Now, since only $1 - x$ of a pound of steam ultimately goes to the condenser, only $1 - x$ of a pound of water will be required to be pumped into the heater, where, mixing with the x part of a pound of steam from the I.P. receiver, the full pound of water, from which the steam was originally generated, is obtained. Now, this x weight of steam parts with its latent heat only, in raising the $1 - x$ weight of water from 100 degrees to 290 degrees. We have therefore the equation

$$x \times 920 = (1 - x)\,(290 \text{ degrees} - 100 \text{ degrees}),$$

from which x is found to be $\frac{1}{6}$. That is to say, that out of every pound of steam which has passed through the H.P. cylinder, $\frac{1}{6}$ of a pound will go to the heater, and raise $\frac{1}{6}$ of a pound of water to 290 degrees; and the remaining $\frac{5}{6}$ of a pound of steam will do work in the I.P. and L.P. cylinders. Now, the heat contained in this $\frac{1}{6}$ of a pound of steam, and which is returned to the boiler and therefore saved, is given by the formula

H (total heat) = L (latent heat) + (T — t) (difference of temperatures).

$$\therefore H = \tfrac{1}{6} \times \left\{ 920 + (290 - 100) \right\}$$
$$= 185 \text{ thermal units.}$$

But in saving this quantity of heat, by returning it with the feed water into the boiler, a loss necessarily takes place in the amount of work done by the engines. This can easily be calculated. At all pressures, steam has a certain potential or capability for doing work, which is expressed by the formula

$$W = p\,v.$$

Where W is the potential of the steam,
p the absolute pressure per square *foot*,
v the volume in cubic feet of 1 lb. of steam at the pressure p.

By not attaching a feed heater to the engine, the steam in the I.P. receiver would be at 70 lbs. pressure, with a corresponding volume of about 6·25 cubic feet per pound of steam.

$$\therefore W = 70 \times 144 \times 6{\cdot}25 = 63{,}000 \text{ units of work.}$$

At the time of release from the L.P. cylinder the pressure would be about 12 lbs. absolute, with a volume of about 28 cubic feet. Therefore the potential of the steam as it begins to exhaust into the condenser is

$$W^1 = 12 \times 144 \times 28 = 48{,}384.$$

Now the work done by the steam in its passage through the I.P. and L.P. cylinders must be the difference of its potential before entering the I.P. cylinder and that before leaving the L.P. cylinder, and this difference is therefore

$$W - W^1 = 63{,}000 - 48{,}384 = 14{,}616 \text{ units of work.}$$

Now let us consider the effect of attaching the heater. The pressure in the I.P. receiver falls to 60 lbs., and that of release in the L.P. cylinder to about 8 lbs. At 60 lbs. pressure the volume of 1 lb. of steam is 7 cubic feet, and at 8 lbs. the volume is about 45 cubic feet. The potential of the steam in the I.P. receiver is now

$$W = 60 \times 144 \times 7 = 60{,}480,$$

and the potential before release in the L.P. cylinder is

$$W^1 = 8 \times 144 \times 45 = 51{,}740.$$

Therefore the work done by 1 lb. of steam in expanding from 60 lbs. to 80 lbs. is

$$W - W^1 = 60{,}480 - 51{,}740 = 8{,}740 \text{ units of work.}$$

But instead of 1 lb. of steam passing through the I.P. and L.P. cylinders, we have only $\frac{5}{6}$ of a lb., owing to the remaining $\frac{1}{6}$ having gone to the heater. The work actually done is therefore

$$\tfrac{5}{6}\,(W - W^1) = \tfrac{5}{6} \times 8{,}740 = 7{,}283 \text{ units.}$$

Without the heater the work done in the I.P. and L.P. cylinders was 14,616 units, and with the heater only 7,283 units are accomplished. Therefore the loss of work in the engine due to the heater = 14,616 — 7,283 = 7,333. But since 772 units of work are equivalent to 1 thermal unit, we have

$$\text{Loss of work} = \tfrac{7333}{772} = 9{\cdot}5 \text{ thermal units.}$$

But the gain by using the heater in warming the feed, we have seen, is 185 thermal units. Therefore the total gain by using the heater = 185 — 9·5 = 175·5 thermal units. The total heat in the pound of steam coming from the boiler is 1,120 units; therefore the gain per cent. by affixing a feed heater to the I.P. receiver

$$= \frac{175{\cdot}5 \times 100}{1{,}120} = 15{\cdot}6 \text{ per cent.}$$

That is, the theoretical efficiency of 1 lb. of steam has been increased 15·6 per cent.; but this has only been accomplished by a diminution in the power of the engine. In our next number we will show to what extent this loss of power per lb. of steam affects the total efficiency of the engine.

(*To be continued.*)

BASIC STEEL FOR SHIPBUILDING.

THE possibility of producing good mild steel from phosphoric ores, by the Thomas Gilchrist process, was proved as early as the year 1879. In 1880 Messrs. Bolckow Vaughan, & Co. were in a position to make 2,000 tons of basic steel per week from Cleveland ironstone. But none of this product was used for shipbuilding; and up to the year 1883 probably no basic steel had entered into the construction of ships or boilers building under the Admiralty, Board of Trade, or Lloyd's survey. In 1883 some basic steel was used for two vessels built in Germany, under Lloyd's classification. The material was made at Oberhausen in Westphalia, and proved unsatisfactory. In January, 1883, Messrs. Parker & Cornish, of Lloyd's, experimented on a quantity of angle bars rolled from blooms supplied by the North-Eastern Steel Co., for a ship building on the Tyne. The tests were on the whole satisfactory, and showed that basic steel could be produced of reliable quality.

However, in December, 1885, extensive failures of basic plates, angles, and beams, occurred simultaneously in several shipyards on the north-east coast of England. An inquiry into the whole matter was at once instituted by Lloyd's Committee, with the result that they declined to accept further supplies of basic steel, until steelmakers were in a position to show, beyond doubt, that a reliable material could be produced by this process.

In March, 1886, Mr. Percy Gilchrist, the surviving patentee, made application to the Admiralty—who up to this time had used no basic steel—for permission to have basic material admitted wherever Siemens' steel was specified. He at the same time offered facilities for thorough testing at the works of the principal manufacturers. Two of the most experienced steel surveyors attached to the Admiralty were appointed to this duty; and a large number of tensile, quenching, bending, forging, and welding experiments were carried out at the works of six different basic steel companies. A trial order for basic plates and angles, to comply with the Admiralty tests for shipbuilding steel, was also given to the Staffordshire Steel and Ingot Iron Company. The order was satisfactorily executed, the plates giving an average tensile strength of 28·5 tons per square inch, and an elongation of 23·5 per cent. in 8 in., and the angles 28·5 tons, and 26 per cent. respectively. Mr. White, the Director of Naval Construction, at the meeting of the Institution of Naval Architects last July, read a paper giving the results of these inquiries, and summed up by recording "the opinion that there is now no reason for doubting the possibility of producing, with proper care, basic steel suitable for ship work." At the same time he emphasised the need for the continued exercise of care and skill on part of the manufacturers.

In the spring of the present year the Glasgow Iron Company intimated to Lloyd's Committee their ability to make basic Bessemer steel equal in all respects to acid steel, made either in the converter or open hearth furnace. An extended series of tests of every description was accordingly commenced by two of Lloyd's surveyors. Mr. Martell, Chief Surveyor to Lloyd's, in a paper "On the Present Position occupied by Basic Steel as a Material for Shipbuilding," also read at the above-mentioned meeting, gives the results of these investigations, which were sufficiently favourable to allow of the acceptance of the steel for vessels intended for classification in the register book. Like Mr. White, he insisted on the necessity for the utmost care on the part of the steel makers, and intimated that Lloyd's surveyors would continue to use extra vigilance in the matter of basic steel, until confidence be fully restored.

The general tenor of these able papers showed that basic steel had, in a great measure, regained the ground lost by the unfortunate failures of 1885. Since the papers were read, nothing has happened to shake this renewal of confidence. On the contrary, basic steel has been steadily growing in public favour. The employment of open hearth furnaces in the manufacture is rapidly extending, and there is every reason to believe that further trial will prove *open hearth* basic steel to be equal, if not superior, to acid Siemens' metal. It should not be forgotten that the attempts made some thirty years ago to use Bessemer steel for shipbuilding were entirely unsatisfactory, and that it was only when open hearth steel came into use, thirty years later, steel shipbuilding began to make progress. Probably the open hearth system will do as much for basic steel as it has for acid steel, and render available for the production of reliable mild steel the practically inexhaustible stores of British phosphoric ores.

The success or failure of basic steel, as we said at the outset, deeply affects the future well-being of our engineering and ship-

building industries. Steel is fast supplanting iron for all constructional purposes; and as about 80 per cent. of our ores are useless for conversion into steel by any acid process, it follows that, in the event of the failure of the present abundant and cheap Spanish supply, mild steel would become a scarce and expensive commodity, unless the practical success of the basic process enabled us to freely utilise our own raw material.

NIGHT NAVIGATION OF THE SUEZ CANAL.

(*Concluded from page 381.*)

BY FREDERICK WALKER.

A PARABOLIC mirror, similar to that shown and explained in the former article, possesses great advantages over other forms, because the loss in reflection of the rays of light is less than when a concave mirror, the surface of which is spherical, is used. The spherical aberration in an ordinary mirror of this kind causes the loss by reflection to be from 20 to 30 per cent., but in the Mangin aplanatic mirror the loss is negligible. This mirror, a section of which is shown by Fig. 1, is formed of two superimposed spherical

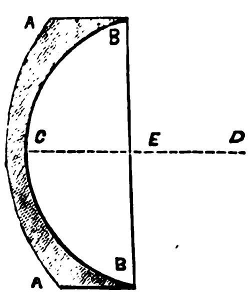


FIG. 1.

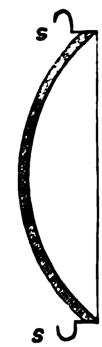


FIG. 2.

surfaces, the outer surface, A, A, being of a greater diameter than the inner surface, B, B. The surface, A, A, is silvered, and the incident rays of light are reflected in a perfectly parallel direction from it, the difference of the radii of the two surfaces neutralising the spherical aberration. The width and range of the beam of light may be varied by removing the arc away from, or towards, the focal point, E, along the line, C, D. The great advantage of this form of mirror over the parabola lies in the fact that the focus is accessible with an ordinary vertical or inclined electric arc lamp of the type usually employed for use in projectors, without the necessity for varying the structure, and thereby impairing the efficiency.

The Anglo-American Brush Corporation fitted a permanent installation on board the s.s. *Austral*, of the Orient Line, in May, 1887, and Mr. Sellon, the electrician to the Corporation, personally superintended the passage through the Suez Canal by means of the

FIG. 3.

electric light. The permanent installation consisted of a Brush engine driving a Victoria dynamo by means of special friction gearing, and the portable plant consisted of a cage fitting upon the stern of the ship, Fig. 3, carrying a projector provided with the usual vertical and horizontal movements. The mirror in this case was a Chance spherical mirror, Fig. 2, supported by springs, S, S, within the projector, so as to allow of expansion and contraction under various degrees of temperature, and also to ensure the safety of the mirror when subjected to sudden jars or knocks. In the Chance mirror the two surfaces correspond, and the glass of which it is made is as thin as possible, so as to reduce the spherical aberration, though it does not eliminate it entirely. The great advantage of this method of construction is the low cost when compared with that of other mirrors for the same purpose.

It is, however, evident that a perfect electric lighting plant for the night navigation of the Suez Canal must be self contained, and perfectly independent of the vessel, so far as the driving power is concerned, in order to render such plant available for any ship that may require to make a quick passage, and yet is not fitted with electric lighting appliances, nor has any suitable steam connections for a portable engine and dynamo, such as was described in the previous paper.

The writer has designed a special apparatus for this purpose, consisting of a platform supported by two cigar shaped shells or pontoons, made of steel plate. Upon the platform is arranged a vertical boiler of special construction, with a duplex dynamo coupled direct to a Brotherhood engine, but so arranged as to be easily thrown out of gear. Upon the forward end of the platform is fixed the projector, also of special construction, and upon either side, within reach of the operator, are two small hand winches, fitted with friction pawls. When it is desired to use the light, the whole apparatus is floated into position, and two guy ropes are placed round the hand winches before referred to, and are hauled taut. A recess in the after part of the platform between the pontoons enables the whole floating apparatus to be drawn close to the stem of the vessel, and also to be propelled by it, being kept central by the stem engaging with the aforesaid recess. In the event of the vessel diverging from the marked course, and taking the bank, the operator in charge of the projector can immediately clear the floating apparatus by releasing one of the hand winches, and winding in the guy rope upon the opposite one.

A propeller of special design is placed centrally between the pontoons, and driven when required by the engine, the latter being, of course, disengaged from the dynamo for this purpose, a simple intermediate gearing then allowing of the rotation of the propeller. This arrangement allows of the floating plant returning to either end of the Canal when the vessel has completed the night passage, in order to be attached to another vessel.

In addition to the advantages to be derived from the use of this apparatus in its ready application to any vessel, the waste of time and delays caused by the somewhat stringent quarantine regulations that exist in Egypt are avoided. As an instance of the loss of time incidental to this, the writer spent an average of sixteen days in quarantine in each month from June till October, 1886, the portable electric light apparatus being detained for the same period, after each trip with the outward mails from Brindisi, the quarantine commencing when the plant was hoisted on board at Port Said.

Two sets of floating electric light plant stationed in the Canal, one to ply between Port Said and Deversoir, and the other between Kabret and Suez, would do good work, and also avoid the unnecessary transit across the Bitter Lake between the north and south lighthouses, where the light is not required.

There can be no better demonstration of the utility of the electric light for the navigation of the Suez Canal, than the fact that some exceptionally quick passages have been made by its aid. Recently a Russian steamer, the *Moskwa*, passed through in 14½ hours; but a reference to the following table of the transit of some of the Peninsular and Oriental Company's steamers will show that this is not the quickest on record:—

Date.		Ship.	Time occupied in passage. Hrs.	Min.	Hours of Electric Light. Hrs.	Min.
1886	June 18th	Ravenna....	16	15	4	0
	July 7th	Bokhara....	17	20	10	0
	November 15th..	Ganges	16	30	9	30
	„ 18th..	Assam......	16	30	10	15
	December 14th..	Verona	15	0	4	0
1887	January 10th ..	Rohilla	14	10	4	55
	„ 27th ..	Nizam......	15	0	7	30
	February 8th ..	Surat	17	0	10	0
	„ 23rd ..	Ballaarat ..	17	10	10	15
	March 17th	Rohilla	17	30	7	30
	March 24th	Surat	17	15	10	30

Apart from the financial value of the time saved to the ship owner, a quick passage through the Suez Canal is highly appre

ciated by the passengers; this particular portion of the voyage being universally acknowledged the most tedious and dispiriting. a wide expanse of desert on either hand, and the slow speed of the ship that is entailed by the observance of the Canal regulations combine generally to promote this view of the matter.

Therefore it is not strange that a preference is given to those lines of passenger vessels which are known to avail themselves of the electric light to facilitate the passage through the Suez Canal, and this affords another instance of the necessity of the adoption of every modern improvement in these days of keen competition, in order to secure and maintain a foremost place; for the progress of improvement renders the arrangement that to-day affords complete satisfaction, obsolete a year or two hence.

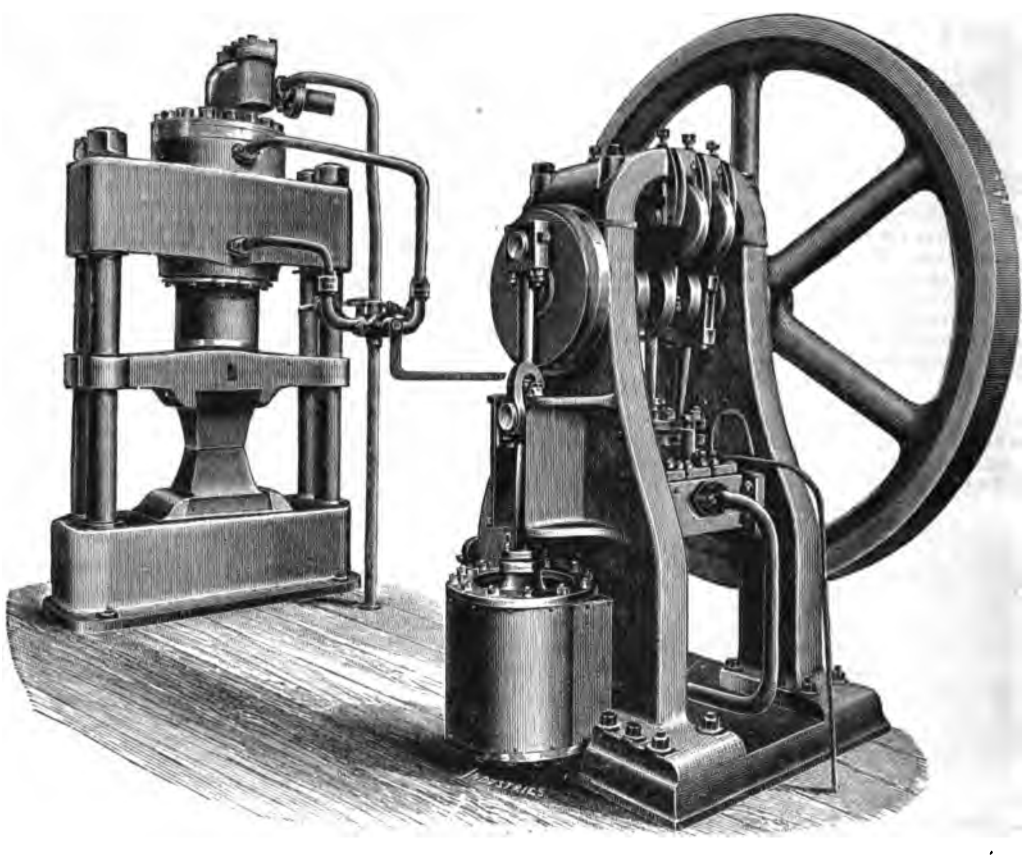
HIGGINSON'S PATENT DIRECT SYSTEM OF HYDRAULIC POWER.

AMONGST the most important of recent inventions is that of Higginson's Patent Direct System of Hydraulic Power, the applicability of which to many purposes appears to be one of the most probable departures in the near future.

Although this system has been some time before the public, it has received but scant notice from the leading weekly technical papers. We have only delayed referring to it until we were in a position to fully illustrate and describe one of its principal applications, viz., to the purpose of hammering, or more correctly, squeezing steel and iron ingots and similar objects. The speciality to which we refer is a 300-ton hydraulic hammer or squeezer, of which our illustration shows a complete external view, as well as one of the engines and pumps by which it is actuated. The latter has also been employed in working three of Higginson's patent noiseless hydraulic winches, specially designed for use on passenger ships, which in a later issue we hope to describe and illustrate. There are many other ways in which this new system of applying hydraulic power can be utilised, but at present we propose to confine our attention to its suitability for forging purposes.

Looking at the illustration, the hammer or squeezer will be seen on the left-hand side. It consists of a vertical cylinder $20\frac{3}{4}$ in. in diameter, which is fitted with gunmetal glands and steel studs and nuts. The cylinder is designed for, and is capable of working with, a pressure of 2,000 lbs. per square inch. The cylinder is supported by four wrought steel columns, which also form the guide for the cross head of the ram, the whole being carried upon a massive cast iron bed plate, of which the anvil forms an integral part. A valve box is fitted to the cylinder for controlling the water supplied from a tank, and there is an arrangement of valves and cylinders for automatically releasing the water when the maximum pressure has been reached.

On the right hand of our illustration is the engine with the pumps. The engine is of the ordinary vertical type, having a cylinder 16 in. diameter, 12 in. length of stroke. It is fitted with metallic packed piston, gunmetal glands, neck bushes, drain cocks, and is cased with sheet bronze. The crank and pump shaft are of steel, and carry the massive fly-wheel, which is 9 ft. in diameter and weighs no less than $2\frac{1}{4}$ tons.



The pumps are of three-throw, having gunmetal rams

4 in. in diameter, and 6 in. length of stroke. The valve box in connection with the pumps is fitted with three gunmetal suctions and three delivery valves with seatings, a spring relief valve being also provided.

The *modus operandi* may be described as follows :—Steam is turned on to the engine, and the series of pumps set in operation, the ram of the hammer is brought down to its work by a head of water, and directly the dies come upon the ingot of steel or mass of iron which it is required to reduce, the pressure of the pumps comes into action, and the momentum of the fly-wheels continues the squeeze till the extreme pressure gradually draws down the ingot or other object. By this means a powerful and comparatively slow squeeze is obtained and an accumulator is dispensed with, while more useful work is performed than by a great number of blows from the ordinary steam hammer. When what has been appropriately styled the pressure blow is completed, the hand lever is thrown out of gear by a self-acting valve, and the ram is raised, then the ingot is turned partially round for another pressure blow, and so on until the ingot or other mass of malleable material has assumed the intended dimensions.

Both as compared with the ordinary method of using hydraulic power, viz., by means of an accumulator, and as compared with steam hammers, decided advantages are—we believe it will be generally admitted—fairly claimed for Higginson's system of applying hydraulic pressure in the operations of heavy forging :—

Several hammers can be worked with one engine and set of pumps.

The steam consumed is proportionate to the work done.

The accumulator is dispensed with, causing great economy in working, as well as requiring a lessened expenditure of capital.

The hammer being self-contained, consequently the foundations needed are light and inexpensive.

A *desideratum* obtained—by no means unimportant—is that there is an entire absence of noise and vibration.

There is also, by Higginson's Direct System of Applying Hydraulic Power, a constant circulation of water through the whole machine, and back through the tank in connection with the pumps.

Although the hammer may not apparently work so rapidly as a steam hammer, yet the amount of work actually performed is greater and more effective, as it has been found that, in dealing especially with large masses of steel, a powerful squeeze is more efficacious in consolidating the ingots than a succession of blows as applied by the steam hammer, as the blows, being comparatively light, produce a hardening and consolidating effect upon the external surface of the ingot, but leave the interior more or less porous. Large forgings made under the steam hammer, as is well known, are often found to be not only porous, but to have cavities in the interior, which are not discovered until the forging has been machined, when it has to be condemned, after a great amount of time has been wasted, thus greatly increasing the actual cost of production. On the other hand, with ingots consolidated by a powerful and gradually applied pressure, as is the method of Higginson's Patent Direct Hydraulic System, the whole of the mass is effectually subjected to a consolidating process, and a forging is produced which is sound to the core.

At the recent Newcastle-on-Tyne Royal Jubilee Exhibition, the highest award and silver medal was granted for the hammer and engines forming the subject matter of this article.

Messrs. Harfield & Co., of the Blaydon Ironworks, Blaydon-on-Tyne, and of London, so deservedly celebrated for their patent windlasses, capstans, and other ship machinery, are the sole manufacturers of Higginson's hydraulic hammers or squeezers.

THE CRANK SHAFTS OF THE ITALIAN ARMOURCLAD "SARDEGNA."

As some of our readers may be aware, the Royal Italian armourclad *Sardegna* is being fitted with *four* sets of triple-expansion engines, each of the twin-screws having two triple-expansion engines in direct connection. There are thus two sets of shafting, identical in every respect. The crank shafts proper of the port and starboard engines are each 59 ft. 11½ in. overall length. The throw of the cranks is 2 ft. 3 in., giving a stroke of piston of 4 ft. 6 in. Each of the six portions of the two shafts has been forged solid from an ingot of Messrs. Vickers, Sons & Co.'s special mild steel, manufactured by their new process, in which a hydraulic squeezing press of 20,000 tons' power is employed. The weight of the whole of the crank shafts is 66 tons. For the after engine the diameter of the shafts is 20 in., with a 10-inch hole bored out, and for the forward engine 16 in. diameter, with a 8-inch hole. In each of the ordinary couplings there are nine bolts 4¼ in. diameter, having a taper about ⅜ of an inch to the foot; and in the couplings between the forward and after engines there are four 6-in. bolts, having projections at their heads, 2 in. in diameter, to which the gear is attached for simultaneously withdrawing the bolts, the wheels of which have 103 teeth.

The engines and boilers of the Royal Italian twin-screw armourclad *Sardegna* are now rapidly approaching completion by the Societá Hawthorn-Guppy of Naples. The designs were prepared by the well-known Tyneside shipbuilders and engineers, R. & W. Hawthorn, Leslie and Company, Limited. The engines are of special interest. The combined indicated horse-power is expected to reach 25,000, but as this would frequently be much more than was requisite for ordinary cruising purposes, the forward set of engines are arranged so that they may be disconnected, and the after engines alone used. The arrangement for working the steam valves is on Mr. F. C. Marshall's well-known system; and the air, circulating, feed, bilge, and fire pumps are each worked by separate engines.

Contract Steel Coaling Lighters.—We understand the Admiralty have placed the order for the 20 150 ton steel coaling lighters for which tenders were recently invited, with Messrs. Edward Finch and Co., Limited, engineers and shipbuilders, Chepstow.

The Manchester Ship Canal.—The fifth ordinary general meeting of the Manchester Ship Canal Company was held on February 20th at St. James's Hall, Manchester. There was a large attendance. The report of the directors was read. It stated that there were now 39,710 shareholders. The total receipts from the formation of the company to the date of the account were £2,834,971, and the total expenditure £2,409,363. The response to the calls had been very satisfactory, considering the vast number of shareholders, the calls in arrear on ordinary shares being under £45,000. The chairman, Lord Egerton of Tatton, expressed his satisfaction with the progress which was being made, and said he had reason to believe that the work would be completed in the estimated four years.

PICKLES' IMPROVED TIMBER PLANING AND THICKNESSING MACHINE.

RECENTLY we had the pleasure of seeing Messrs. John Pickles & Son's improved planing, surfacing, and jointing machine; and as in its construction and equipment there are novel features, an illustrated description may not be devoid of interest to our readers. Fig. 1 gives a general view of the machine, the main frame of which is cast in one piece, and being very strong and self contained, does not require any special foundation. The feeding of the timber through the machine is effected by means of four rollers, two on each side of the cutters, the top rollers being driven, the front one being grooved. These rollers are fitted with an efficient variable spring pressure arrangement. Between the feeding rollers and the cutter spindle, pressure bars are provided, having special mechanism for keeping in position upon the bed of the machine the timber undergoing the process of planing, &c. The bed or table is provided with lips, which obviate the indenting of the timber, a short distance from the end, and is raised or lowered by means of a hand-wheel bevel and screw motion on each side of the machine, to suit the different sizes of timber to be operated upon. An index and pointer finger is provided, showing at a glance the measurement of the object passing through.

Possibly the principal novelty in Messrs. John Pickles and Son's improved planing, surfacing, thicknessing, and jointing machines is the utilization of Rawling's Patent Spiral Cutter, which we illustrate in Fig. 2. It is a well-known fact that while machines with straight cutters are found very useful for working soft and common woods, they are sadly deficient, if not frequently entirely inefficient, when hard and gnarly, or cross-grained timber has to be worked. In any case, with timber of the latter description, an extra amount of hand labour is necessitated, in order to obtain the necessary face and finish. To obviate and remedy the above defects various means have been adopted. Prominent amongst the devices tried is a cutter spindle presenting the cutting edge of the cutter to the wood with a little lead or shear. The cut obtained is termed a shearing cut, but practically a chopping process is the result, all the work being done by the cutter which projects most. Rawling's Patent Spiral Cutter avoids this difficulty, and renders the planing of the most curly timber, parquetry, or other similar difficult work in the joiners' shop of a shipbuilding yard, quite an easy and inexpensive process. As will be seen from Fig. 2, the blades of this cutter have an angle of about 20 to 30 degrees, so that it gradually enters the timber under operation, taking up a very fine shaving. When a blade has worked for about 7½ in. in width, another blade commences cutting, so that with a 30 in. cutter, all the blades will be working at the same time. There is thus a continuous, smooth and even process, without vibration or shock to the wood or the cutter, so that the work produced is perfectly true and without rough places or other defects.

The cutter spindle is of a square section, formed out of a bar of steel, and shaped by special machinery to a spiral form. Upon each of the four sides a blade or cutter is fixed permanently, being carefully secured by screws. The blades or cutters are of a peculiar form, for the manufacture of which carefully devised plant has been put down. After the blades are attached to the spindle, they are then tempered and machined perfectly true and straight upon the spindle. The patent spiral cutter is then placed in its own bearing on the machine.

In Fig. 3 we illustrate an improved patent grinding apparatus, which has been specially designed to produce the necessary relief of the cutting edge, and for grinding the cutters from time to time. This grinding apparatus can be readily secured in position upon the table of the machine by bolts, as shown in the illustration, and consists of a fine emery wheel fixed upon a sliding arm, which is manipulated backwards and forwards by means of a hand wheel and screw working in the hollow shaft. Parallel with it is a revolving shaft, upon which is a pulley (with feather key) free to move along with the sliding arm, and through a light leather belt the power is transmitted to the emery wheel. The driving pulley at the end of the shaft is so arranged that it may be driven from the same pulley which drives the cutter spindle, thus obviating the expense of an additional counter-shaft and pulleys. A steel guide is fixed close to the emery wheel, and against this guide the inside edge of the cutter is pressed by means of a weight and cord fixed on the spindle pulley. This enables the cutter to be presented in its entire length at one uniform angle to the emery wheel, and whilst the screw shown at the end of the arm regulates to the greatest nicety the process of sharpening, there is no danger of inequality in the diameter and angle of the cutters resulting. There is thus an assurance that each cutter will always perform its relative amount of work.

While solidity and reliableness of construction has been kept well in view in designing this improved planing and thicknessing machine and its accessories, the question of weight has not been lost sight of. The approximate weight of a machine to plane any width up to 12 in. and 9 in. in depth is slightly over half-a-ton. One to admit timber up to 3 ft. in width weighs about 23 cwt., but six intermediate sizes are obtainable of relative utility and weight.

Having so fully described Messrs. John Pickles & Son's ingenious improvements in wood planing machines, together with the all important cutter sharpening arrangements, we can only say, in conclusion, that having seen their patent machines in operation, we can testify to the regularity with which the hardest and most cross-grained timber is planed by them. Parquetry, it is well-known, presents unusual difficulties in the finishing process, owing to the variety of the "grains" to be dealt with, but even with it there was not the slightest trouble in obtaining a first-class and most satisfactory result.

We can commend this speciality of Messrs. John Pickles & Son, who are well-known saw mill engineers and wood-cutting machinists, at Hebden Bridge, near Manchester, to shipbuilders, engineers, and others who require a reliable wood planing machine suited for all descriptions of timber.

New Fast Sloop of the Buzzard Type.—The dockyard authorities at Sheerness have received instructions to build another new fast sloop of the Buzzard type. The proposed vessel has been designed by Mr. W. H. White, Director of Naval Construction, and will have a displacement of 1,040 tons. She will be 208 ft. in length over all, and will have a breadth of 30ft. She is to be fitted with triple expansion engines of 2,000 H. P. Her armament will consist of eight 5in. steel breechloading guns, mounted on Vavasseur fittings, and four 1in. Nordenfelt guns and four ·45in. Gardner guns.

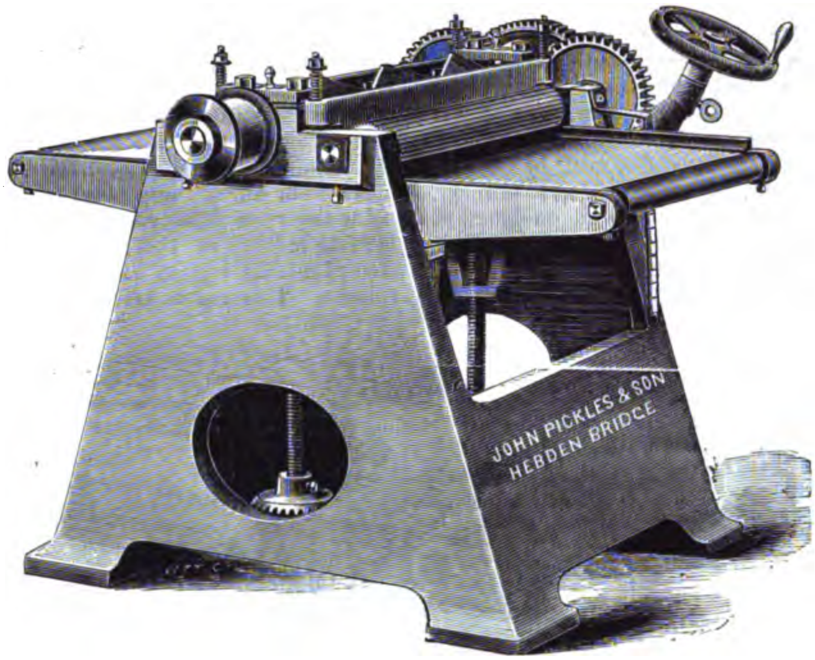


Fig. 1.

Fig. 2.

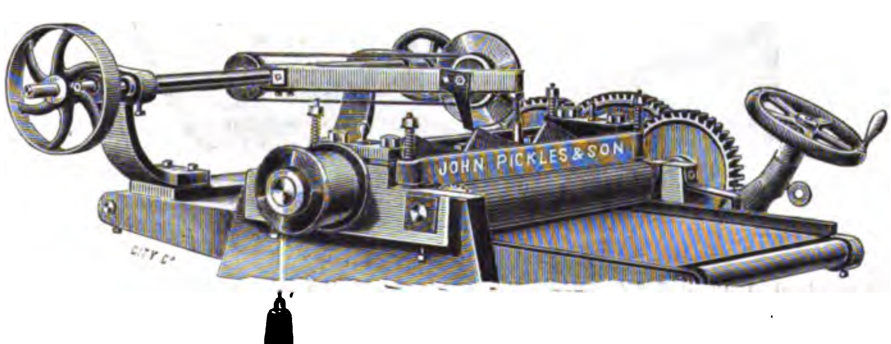
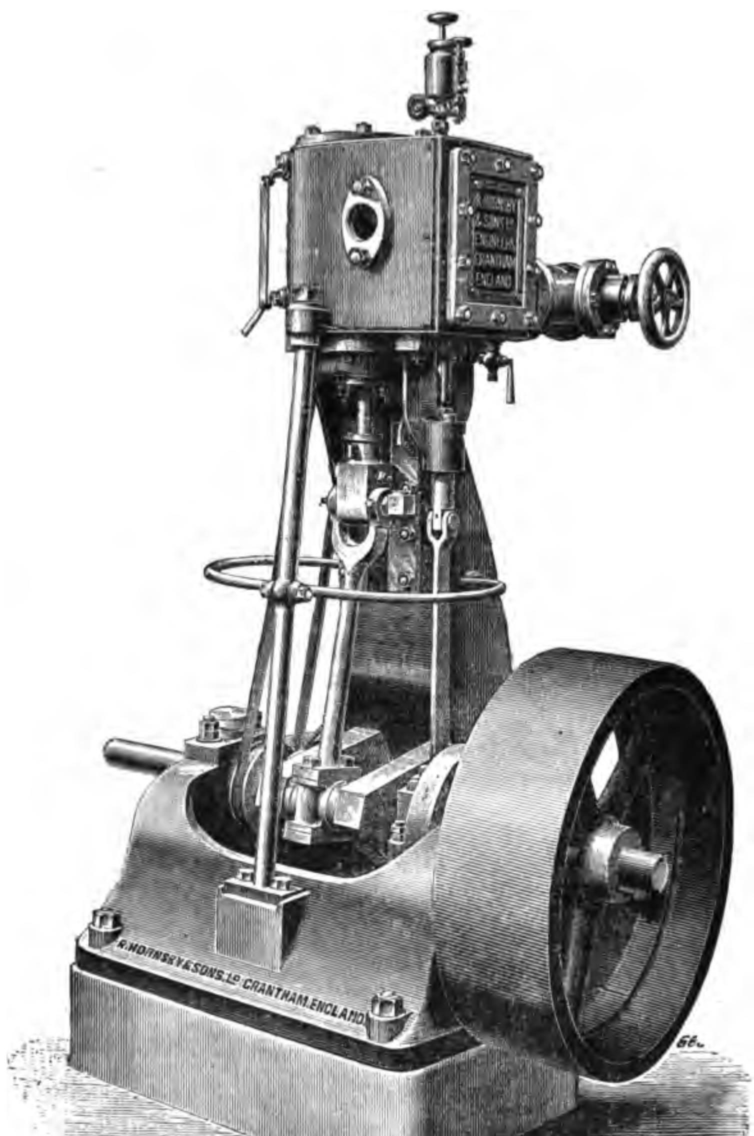


Fig. 3.

HIGH SPEED VERTICAL ENGINE.

THE "era" of the electric light has been the cause of great advances in the designing and construction of "high speed" engines; and amongst the most successful efforts in this direction that we have seen is the overhead vertical engine we now illustrate.

This engine has been specially designed by Messrs. Richard Hornsby & Sons, of Spittlegate Ironworks, Grantham, for electrical engineering work on board of steam vessels, &c., and owing to its compactness it appears to be very suitable for the purpose. The cylinder, which is 7 in. diameter, with a length of stroke of 9 in., is supported by a cast-iron pillar of box section, which, with the crank shaft bearings and bed plate, are all in one casting. The cylinder and valve chest are well jacketed, and as the engine is designed to run at a speed of 400 revolutions, which has been regularly attained, the pipes and ports are made unusually large, and all the reciprocating parts are well balanced. The piston rod is of steel, and the cross-head works in a slipper slide. The connecting rod is of the marine type, and the crank shaft is steel. All the bearings are of large proportions, and the lubricating arrangements are well attended to throughout. The governor is of a new type, and forms a special feature of the engine. It consists of a circular flat spring, made from an ordinary piece of ribbon steel. At one point this ring is fastened to the driving spindle, which is made hollow; at the opposite point a sliding brass is riveted to the spring, which works a rod in a hollow spindle. This rod is attached direct to an equilibrium throttle valve. The speed of the engine can be varied when desired by means of a spring which is attached to the end of the sliding rod, and which bears against the end of the driving spindle, and can be compressed or released by means of a nut and lock-nut. Provision is



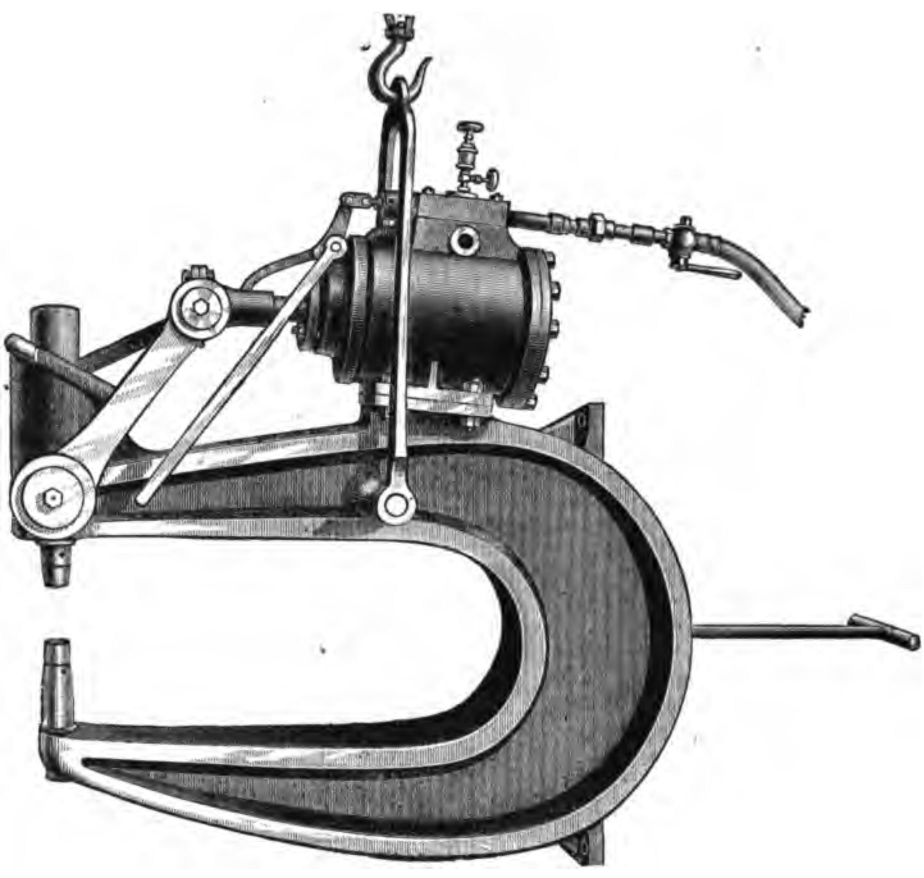
also made to prevent any accident happening, should such an unforeseen and unlikely circumstance arise as the breaking of the spring. By means of this simple and efficient governor, the speed of the engine can be varied from 200 to 600 revolutions per minute. We have seen the engine at work, and can testify to its smooth and regular working. Its compactness has already been referred to, but our readers have an opportunity of judging of that quality by the illustration we give.

Similar engines were working in the electric light department at the Manchester and at the American Exhibition, London, with, we understand, uniformly satisfactory results.

ALLEN'S PATENT PNEUMATIC PORTABLE RIVETING MACHINE.

STEAM, water, air, and gas are all competitors in the world of mechanics as motive powers, and it is a work of difficulty to decide upon their relative merits, in all the varying circumstances of the shipbuilding yard, boilermaking shop, and similar establishments. No doubt each of these motive powers have their special advantages; but without attempting to assign their respective domains, we have to call our readers' attention to the successful use of air in riveting. This has been attained by Allen's Patent Pneumatic Portable Riveting Machines, for which Messrs. De Bergue & Company, Limited, of the Strangeways Ironworks, Manchester, have secured the appointment as sole licensees and makers for Great Britain and the Colonies. They were first brought out in the United States of America, where large numbers are successfully employed. In the short time Allen's Riveter has been in the European market, it has also been favourably received.

We illustrate one of the ordinary forms of Allen's Patent Portable Riveting Machines. It will be seen that they are of light construction, and in order to provide the necessary strength, the machines are constructed almost entirely of steel. Their action is extremely simple. The compressed air is admitted to the cylinder by a hand valve at each stroke of the header, and the pressure from the piston is conveyed to the vertical heading ram through differential levers, forming in combination a toggle joint, so that the pressure on the heading ram, moderate at first, rapidly increases as the ram descends, and attains its maximum at the moment when the heading operation is completed. Thus, with a small cylinder of 10 in. diameter, a pressure of about 50 tons can be exerted, which is amply sufficient for rivets of 1 in. in diameter. In practice less than this is found to be sufficient, and for the various sizes of rivets the pressure can be regulated at pleasure, so that no more motive power need be expended than necessary.



The heading ram descends in a direct line with the axis of the rivet, and the machine being suspended from its centre of gravity, it will work either horizontally, vertically, or at any angle. It will head rivets as fast as they can be placed in the holes, from about 200 to 400 rivets per hour, according to the nature of the work. It is operated by one unskilled man, another to place the rivets, and a boy to traverse the crane as the work proceeds.

Messrs. De Bergue & Co. have only after an extended trial of the Allen Patent Pneumatic Portable Riveting Machines in their own yards, ventured to claim for it such an immense superiority over any other portable riveter, as to justify them in saying it is the *only real* portable riveter yet introduced. For ourselves, we may state that it appears to be specially advantageous, where, there is not easily obtainable an abundant supply of water for hydraulic power; and further, in small shipbuilding yards, where it is advisable to adopt mechanical riveting on the beams, frames, floors, &c., it would appear that this pneumatic riveter should be very acceptable, as it is claimed, that the work executed by it is equal to that of the best hydraulic machines, much greater in quantity, and at one-half the cost, while the expenditure on plant is also placed at the same proportion. The expensive accumulators required for hydraulic machines are dispensed with, together with the complicated system of swivels, slides, and folding pipes, which so greatly limit the scope and usefulness of portable hydraulic riveters. It need scarcely be remarked that there is an immunity from freezing up and consequent bursting of pipes; while there is also no necessity for return pipes.

To complete our notice of this Pneumatic Portable Riveter, it only remains for us to refer to the requisite air compressor. This need only be of a small size, driven off a belt, or by a direct acting steam engine. To ensure uniformity of pressure in the pipes, the air passes first into a closed wrought-iron receiver, which may be about 4 ft. diameter by 6 ft. in length, and from this receiver the compressed air is conveyed at a pressure of about 70 lbs. to the square inch, by ordinary wrought-iron tubing to convenient fixed points, and thence by ordinary flexible tubing, about 1 in. bore, to the riveters. An air compressor and receiver of the above size will serve two or three riveters. The usual sizes of Allen's Riveters vary from 10½ in. to 55 in. gap, and weigh from 800 to 3,300 lbs., the larger sizes being so constructed as to be easily made available as stationary riveters.

In connection with these Portable Riveters. Mr. Allen has also patented a High-Speed Air Compressor, of which pressure on our space precludes a description. We may, however, state that there are about one hundred of them at work in connection with the riveters; and actual experiment has shown they will do twice the work of equal sized ones made on the ordinary principle.

THE ITALIAN EXHIBITION.—The King of Italy, himself the patron of the forthcoming Italian Exhibition in London, has permitted the Crown Prince of Italy (the Prince of Naples) to accept the honorary presidency of the exhibition. Over 1,200 exhibitors in Italy have already applied for space.

YACHT CONTRACT.—Sholto C. Douglas, Esq., of Douglas Estate, near Coatbridge, has commissioned Messrs. Fleming and Ferguson, shipbuilders, Paisley, to build for him a 40 ton steel steam yacht. She will be fitted by the builders with their patent quadruple expansion engines.

LEWIS' PATENT FLEXIBLE TEXTILE VALVE.

WE are pleased to see that the flexible textile valve, patented by Mr. Lewis, and manufactured by the South Wales India Rubber Company, at their extensive premises in West Bute Street, Cardiff, is being satisfactorily reported upon by engineers from all quarters.

This valve is more particularly adapted for use in the air-pumps in steamers, and being unaffected by grease or heat, it will not "crack" or "break"; its lasting properties are, therefore, greater than obtains with india rubber or metal valves; in fact it has been proved that oil and heat, in moderation, rather improve the working of the flexible textile valve. These valves are made from pure Baltic hemp specially manufactured and prepared, and having the different layers sewn together. By this means not only is a strong and compact valve produced, but it is asserted by the makers that the valve so made is 75 per cent. lighter than an india rubber valve to do the same duty. Though so much lighter than india rubber, a perfect vacuum is kept, and there is no necessity to alter the guards when fitting these valves, whether the guards have previously been used in connection with rubber or metal valves. Upwards of a thousand steamers have been supplied with the flexible textile valves, and we are pleased to know that the firm are being kept well employed with orders, several coming from companies owning the largest steamers afloat.

TRIAL TRIP OF A PETROLEUM STEAMER.

THE trade in carrying petroleum in bulk has lately assumed great importance, as the advantage of doing away with the expense of barrels, and the labour attendant upon making and stowing them is of great importance to the consumer by cheapening the cost of import. The first vessels built on the Clyde for this new and important trade are the *Ocean* and *Chester*, lately launched by Messrs. Russell and Co., of Port Glasgow. These vessels are sister ships, 310 feet long, 39 feet beam, and 23 feet depth of hold, and are capable of carrying 3,500 tons of oil, and 300 tons of bunker coal. They are divided into 16 separate oil compartments, and into 23 separate watertight compartments altogether, and are thus, from an underwriter's point of view, unusually safe against the risks following collision or stranding. They are built of steel throughout, and the machinery, which consists of triple expansion engines, with cylinders 22in., 36in., 58in. and 42in. stroke, working at 160 lbs. boiler pressure, is constructed by Messrs. Duncan, Stewart and Co., of Glasgow. Both the ships and machinery are from the specification and under the superintendence of Messrs. Flannery and Blakiston, consulting engineers, Liverpool. On the trial trip, February 24th, the highest speed (the vessels being loaded down to their full cargo carrying draft) was $11\frac{1}{10}$ knots, and the true mean speed over a series of runs on the measured mile was 10¼ knots—a result which was nearly a knot in excess of the builders' contract, and was considered exceedingly satisfactory by all on board. The engines worked with remarkable smoothness, and there was not a heated bearing throughout the trial. In view of the special character of the vessels, they have been inclined, and their stability calculated by Professor Jenkins, of Glasgow University, and in this respect they have been found entirely satisfactory. These vessels were built to the order of Messrs. Hermann Stursberg and Co., of New York, and are registered in Liverpool. Amongst those present at the trial were—Mr. Randebrock, the owner; Mr. Russell and Mr. Lithgow; Mr. Stanbury and Mr. Sanderson, Lloyd's Surveyors; Mr. Flannery and Mr. Blakiston; Mr. Duncan Stewart and Mr. Petersen; and Captains Wohlmuth and Schmidt.

THE SPEED OF WAR SHIPS.

REAR-ADMIRAL THE HON. E. R. FREMANTLE, C.B., C.M.G., on Friday, February 3rd, lectured at the Royal United Service Institution, Admiral Sir Edward Fanshawe presiding, the subject being the speed of ships as a factor in sea warfare.

The Lecturer (who is a gold medallist of the Institution) commenced by referring to what he termed the "unerring teaching of history" in showing that speed was an enormous factor in engagements of old, and he argued that it would be no less important in these days, when wars must be short, sharp, and decisive. Erroneous conclusions, he said, had been drawn from our former naval history. It had been said that our ships of the line in bygone times were inferior in sailing to foreign ships opposed to them, the French in particular; and it was urged that, as our victories were gained notwithstanding this inferiority, speed under steam was of little value in large ships, whether considered strategically or tactically. It was also supposed that our naval heroes of the past cared little about superiority of sailing, and that we might do the same. A careful study of naval history negatived the assumption that our ships were generally inferior in sailing to those of our opponents, and it was rather the complaint and natural indignation of our admirals when for a time their ships were inferior in mobility which had given rise to the mistaken notion to which he had referred. The contrary was the rule, and bitter complaints were made when from exceptional causes our fleets were inferior in these respects. From the time of the Armada, when the smart sailing frigates and pinnaces of Howard and Drake, Frobisher and Hawkins, danced round the heavy Spanish ships which they harassed, annoyed, and eventually destroyed by their policy of worry, mobility was a tradition in the British naval service. The unfortunate Byng, indeed, pleaded that the French ships had greatly the advantage in point of sailing, which enabled them to fight or to avoid fighting as best suited their purpose; and it was possible that owing to foul bottoms (for ships were not coppered in 1756), the French might have had the advantage he spoke of; but it was, at least, curious that three years later Boscawen in the Straits of Gibraltar, and Hawke off Quiberon, won their victories by bringing the French ships which were endeavouring to escape to action. He gave other instances to the same conclusion, and then proceeded to say that of recent years both the late and the present Boards of Admiralty had aimed at giving considerably increased speed to our men-of-war of all classes. This was satisfactory, as a few years since we were falling behind the French, and still more the Italians, in this respect. The ironclads of the *Admiral* class, and the belted cruisers designed by Sir N. Barnaby formed groups of the fastest vessels of the world of their respective classes; and we were witnessing in the last two years, from the designs of Mr. W. H. White, our present Assistant-Controller of the Navy, a transformation of almost all classes of ships into cruisers of extraordinary speed, such as would have been impossible of attainment some years ago. The lecturer presented tables showing the distances French and English ships could cover—the French having 14 knots and the English 12—and showed how the British ships could be out-run, Gibraltar being passed by the French 12 hours before the British could reach there, and he commented upon the serious position in which we should thus be placed. He then presented a series of tactics, and exhibited the high value of speed in fighting, the higher speed ships having choice of position. He dealt then with the subject of coal capacity of ships, and argued that this should not be unduly reduced, but that coal capacity should be considered as part of the speed. He presented a table of the fastest ships in the world, built and building, and the total number of ships in this list was 98, belonging to the following countries:—British, 31; Italian, 18; French, 23; German, 6; Austrian, 4; Chinese, 3; Russian, 2; Spanish, 3; American, 3; Japanese, 2; Chilian, Greek, and Turkish, 1 each. The recent improvements in the marine engine had been so great as to amount to a revolution in naval warfare, as they had already revolutionised trade. To sum up, in conclusion, the lessons which he thought we should derive from the more recent developments of the marine steam engine, and the weapon which it had placed within our grasp, he was not blind to the necessities, so far as he could see at present, of protection for fighting ships, while the melinite shell, the dynamite gun, the torpedo, and the submarine boat all demanded attention; but he held firmly that the greatest changes of all in naval warfare must result from the giant motive force, which would enable combinations to be made hitherto undreamt of in our philosophy.

A discussion followed, in the course of which Mr. White, the Assistant-Controller of the Navy, said that he had come to listen to the views of naval officers on the designs of Her Majesty's ships; but he could not leave unnoticed some views which had been expressed respecting the alleged paper speed as compared with the actual speed of the ships. As to the *Curlew* having lost two-and-a-half knots in taking in extra coal, he said that there must have been other circumstances besides the additional coal to cause the loss of speed in this case. As to allegations made by a speaker respecting paper superiority of English ships, and actual superiority of foreign vessels, he said that they were completely erroneous; for the English speed was genuine, and, in point of fact, the English ships were tried more severely than were the ships in any foreign navy. The statements as to the speed of English ships being merely on paper were loose and without foundation. The ships were certainly tried at their best, and the obtaining of more speed in ships was only a question of money. The speed of ships of the Royal Navy had been continuous over the last ten years; and the view taken of the position of the British Navy, in this respect, might be judged by the lament of the French Budget Committee, who called attention to the fact that the French ships had less speed than the English.

THE S.S. "CITY OF BERLIN."

THE Inman and International Steamship Company's steamer *City of Berlin* has been renovated and supplied with new machinery by Messrs. Laird Brothers, Birkenhead. Her dimensions are:—Length over all, 510ft. 6in.; breadth, moulded, 44ft.; depth from spar deck, 36ft. 3¼in.; gross tonnage, 5,000 tons. The alterations made on the vessel by Messrs. Laird are of an extensive character. She has been fitted with new engines of the triple expansion type, the cylinders being 41in., 65in., and 101in., by 66in. stroke, and capable of developing 5,500 indicated horse-power. The total space occupied by these engines is no more than that taken up by the old engines, although the power is now about 20 per cent. greater. Steam is supplied by eight boilers of the cylindrical return tubular type, each having three furnaces. Grate surface is 324 square feet, and total heating surface 14,600 square feet. The boilers are made of steel, carrying a working pressure of 150 lb. per inch, and have been tested to the Board of Trade requirement of 300 lb. per inch. These boilers are worked under Howden's system of forced draught, the air being supplied by four centrifugal fans driven by independent engines. Two of the fans are driven direct and two are belt driven. The space occupied by these boilers is so much less than was occupied by the old boilers that a gain of six first-class state rooms on the main deck and officers' cabins on the upper deck, besides an addition of cargo space, has been obtained, and the consumption of fuel and space required for coal is greatly reduced. Circulating water for the condensers is supplied by two Tangye pumps, each worked by a separate pair of engines, and there are also Worthington engines and pumps for the main and auxiliary feed, and for fire and sanitary purposes. The crank shaft is of the built type; it and the propeller shaft are of Whitworth compressed steel. An evaporator is fitted in the engine-room capable of making 15 tons of fresh water in twenty-four hours to provide for waste and an auxiliary condenser, to which the exhaust steam is carried from all the auxiliary engines, winches, heating pipes, steering engine, &c., and the water thus saved put back into the boilers. The electric light has been fitted throughout the ship, the electricity being supplied by duplicate sets of Clarke, Chapman, and Parsons' engines and dynamos, capable of supplying the whole lighting required, so that there is now no possibility of failure. The ship's hull has been thoroughly overhauled; the upper and main decks have been completely plated with steel or iron, and additional sub-divisional water-tight bulkheads have been introduced. She has new decks and deckhouses, the promenade deck being extended to 180ft. in length. The rig has been altered from the old ship rig of the Inman Company to that of the three-masted schooner, giving her a much lighter appearance afloat. The entire accommodation has been re-arranged. The saloon has been re-decorated, about forty first-class state-rooms have been fitted amidships forward of engines and boilers, and new companion-ways giving access to the promenade deck are fitted. In addition to the complement of boats required by the Board of Trade, three collapsible lifeboats are provided—two on Berthon's and one on Chambers' patent—each capable of accommodating eighty to

100 passengers. Fire-extinguishing apparatus by means of steam jets and water is supplied throughout the ship.

The trials of the ship were made outside the port of Liverpool on January the 22nd and 23rd, with the following result:—

Steam:—	
Boilers	152 lb.
Engines	149 lb.
Inter. receiver	42 lb.
Low receiver	12½ lb.
Vacuum	25½ in.
Revolutions..	66·3
Mean cylinder pressures:—	
High	67·3 lb.
Inter.	25·7 lb.
Low	12·5 lb.
Indicated horse-power:—	
High	1963
Inter.	1885
Low	2177
Total	6025
Fans:—	
Air pressure at fans about..	2¾in. water.
,, reservoir ,, ...	1¾in. ,,
,, ashpits ,, ...	¾in. ,,
Temperature of air at inlet to fans	94 deg.
,, ,, ,, ashpit ..	225 deg.
,, feed-water	130 deg.
Indicated horse-power per foot of grate ..	18·6
Heating surface in square feet per I.H.P...	2·42

It will be seen that the horse-power per square foot of grate is very high.

The great success which has attended the alterations in the ship and her machinery reflect much credit on Messrs. Laird Brothers, and will add, if possible, to the high reputation of the firm.

SWANSEA TRADE IN 1887.

THE annual return of the trade of the Swansea Harbour for the year ending December, 1887 (the issue of which has been delayed, owing to the vacancy in the harbour superintendentship), has now been published. It states that the import trade, as compared with the year 1886, shows a slight decrease, which is to be attributed to the extreme depression which characterized the general commerce of the country, and particularly the metal industries of this district, for the first three quarters of the year. Decreases are shown in the following import trades—namely, in copper, silver ore, &c., 20,000 tons, in iron ore 7,000 tons, in iron, steel, &c., 10,000 tons, and in pitch 7,000 tons. On the other hand the increases in the import trade include zinc ore 8,000 tons, timber 3,500 loads, building material 3,300 tons, sulphur ore and pyrites 10,000 tons, and food 1,000 tons. The export trade gives an increase of 106,880 tons as compared with 1886. The shipments of coal, it is satisfactory to note, have increased by 91,494 tons, or 7·3 per cent., and are the highest yet recorded in the history of the port. Increases are also to be observed in the exports of:—Iron and steel 10,000 tons, tin-plates 9,549 tons, bricks and fireclay 4,000 tons, and chemicals 3,700 tons; but there is a decrease of 12,000 tons in the shipment of patent fuel. For North American ports 1,974,418 boxes of tin-plates were shipped during the year, of a total net weight of 122,868 tons, being a decrease of 5,464 tons compared with 1886. This decrease may be accounted for by the inability of tin-plate makers to deliver to buyers owing to the unprecedented drought, which lasted from the latter end of June until September. As a set-off, however, 5,124 tons were exported to Batoum, this being a new market. The total shipment of tin-plates in the past year was 200,922 tons, which estimated at £14 per ton, the average price current during the year, represents a value of £2,812,908. The imports (foreign) were 279,136 tons, and the exports 1,383,710 tons. The imports coastwise were 307,438 tons, and the exports 524,242 tons. The entries of tonnage, compared with the previous year, give an increase of 83 vessels and 51,606 tons net register. As regards nationality, increases are displayed in the tonnage of British, French, Norwegian, Danish, Swedish, Russian, and Spanish vessels coming to Swansea. The tonnage of Spanish vessels has nearly doubled as compared with 1886. The gross traffic which passed over the harbour railways last year amounted to 1,536,181 tons, as against 1,487,455 tons in 1886.

THE GREENWICH FERRY.

THE launch of the *Countess of Lathom*, the first boat of the new Greenwich Ferry Company, from the yard of Messrs. Steward and Latham, Millwall, on February 13th, was in every respect successful. Numerous invitations had been sent out, and the day being dry and promising, there was a large and fashionable attendance. The offices, temporarily transformed into reception rooms, were for a time in possession of friendly disputants on the wants and prospects of the south side and on the adequacy of the ferry boats to cope with the average traffic—the general feeling at the close being that the Company had a well assured future in store for them. From the offices there was an adjournment to the yard, with its smith's shops, and furnaces, and plates, and workmen, and to such examination of the ponderous hull as circumstances permitted. Then there was a grouping at the ship's head, and the pendant bottle with which the Countess de la Warr was to salute the hull as soon as the last of the dog shores had been knocked away. The waiting was not long, only for the passing of a barge or two upon the river, when the hammer noise suddenly redoubled, the fabric shook, then moved, and at last took the water, amid deafening cheers. The dimensions are 120 feet in length over all, 40 feet broad to outside of plates, and 11 feet deep from top of beam to top of floors. The draught is 6 feet, and the displacement 466 tons. The boat is steel built, and will be driven by twin screws, 6 feet in diameter, at each end. She will have two pairs of compound surface condensing engines with 18-inch and 33-inch cylinders and 24-inch stroke. Steam will be supplied from two return tube boilers 11 feet long by 10 feet in diameter. The decks of the boats will be of ¼-inch steel, covered with 4-inch timbering and 4-inch wood block paving. She is of very powerful build, so constructed that she will ride at the landing-stages of each bank, her sides looking with the pier, and open for carts and carriages. It is estimated that the ferry-boat will be able to hold as many as fourteen carts. The construction is different from that of the American boats, inasmuch as that the traffic does not enter end on, but at the sides. By this method it is believed that more traffic will be admitted. Rails are also laid for the admission of railway trucks, and the traffic will be taken on and off the steamers at the level at all states of the tide.

After the launch there was an adjournment to the Ship Hotel, Greenwich, where a sumptuous lunch had been provided. Admiral Sir Edward A. Inglefield, the chairman of the Company, in an admirable and spirited speech expressed his satisfaction with the ship. He held strongly to the opinion that the operations of the Company would prove of much general advantage to the public, and of much special benefit to the vast industrial population behind Greenwich. For his part, and on behalf of his brother directors, he engaged that the public convenience would, at all times, be their constant study, and that it would be a pleasure to them to provide adequately and promptly for the prospective traffic. He then asked that a bumper might be filled to the builders, with whom the most cordial relations had been and would continue to be maintained. Mr. Hart, deputy chairman, also spoke, and concluded by proposing "The health of the Countess de la Warr," whom he warmly thanked for officiating at the ceremony. Earl de la Warr briefly responded, wishing all prosperity to the Greenwich Ferry Company.

THE ANCHOR TRADE.

A LARGE number of orders are at present being executed upon the Tyne for Tysack's Improved Patent Stockless Anchors, and, amongst others, several of about three tons weight each, for a Government cruiser now building. The anchors for this vessel are to work direct into ordinary shaped circular hawsepipes, without the intervention of fishing and catting gear, on the system introduced by their patentee into ocean-going merchant steamers four years ago; and although this is not the first fast cruiser fitted to work with his anchors on this self-stowing system, yet she will be the largest one so equipped, and for vessels of this type, that may require to "let go" or "heave up anchor" at a moment's notice, the system certainly possesses many and important advantages.

Almost the whole of the anchors for some time past made by the patentee, and now being manufactured, are working, and to be worked, upon his self-stowing plan, which has become extensively adopted and is coming daily, more into favour with nautical men.

THE PHOTOGRAPHIC EXHIBITION AT THE CRYSTAL PALACE.

AMONG the many interesting exhibitions of various kinds that have at different times been held at the Crystal Palace, none that we remember has been more pleasing or complete, in its way, than the present one.

Every size and variety of photographic apparatus is well represented, from the tiny "detective" camera (which allows you to take a friend's photograph, in some cases 12 times over, while he is talking to you, and unknown to him) to the monster instruments exhibited, notably by the Eastman Dry Plate and Film Company, of 13, Soho Square, W., and Messrs. W. Watson and Sons, of 313, High Holborn, W.C.

Where every article exhibited is of such a high standard of excellence, it would be invidious to single out any particular firm or exhibitor, and we therefore can only urge upon our readers to go and see for themselves all that is shown in this unique and interesting exhibition.

From an engineering point of view, it is doubtful whether any camera in the exhibition is built with greater regard to mathematical accuracy in all its movements than is the one exhibited by Mr. J. R. Gotz, of 19, Buckingham Street, Strand, W.C. Not the least interesting part of the exhibition is to be found in some 700 examples of the photographer's art, but as these appertain strictly to the artistic, it does not come within our province to describe them. We may mention, however, some excellent views of yachts taken under full sail, and a splendid picture of the Spanish cruiser *Isla de Luron*, taken when going full speed, as being most likely to interest our readers.

EXHIBITION OF PATENTED AND OTHER ARTICLES AT THE CRYSTAL PALACE.

WE have received a circular from the Crystal Palace Company, in which our attention is called to the fact that it is proposed to let off space in the gallery of the Palace, to the extent of about 3,000 square yards, for the purpose of exhibiting and selling British, Colonial and Foreign manufactured goods, patented articles, and, by aid of models so exhibited, the patents relating thereto.

We were told, on a recent call at the manager's office, that sufficient applications for space had already been received to warrant the company in erecting shops after the oriental style, to be occupied by those exhibitors who preferred that method of exhibiting their products.

An office will be opened in the gallery for receiving and forwarding orders for goods exhibited, and a store will also be opened wherein stocks may be kept.

Mr. Henshaw Russell, the manager, will give any further particulars that may be required.

A NEW STEAMER FOR SALMON FISHING.

ON Saturday, 28th January last, the new steamer *Erwartung*, built by Mr. E. Ongley, of Memel, for the salmon fishing from that port, proceeded to sea to lay down the salmon lines. The weather was very favourable when the steamer started at 9 a.m., and after running about 25 knots out to sea, 320 lines were set, taking the steamer about three knots farther, where her head was again turned towards the harbour. She arrived back about 12·30 p.m., having steamed continually for 15½ hours, the engines working without a hitch even when running very slow during the laying of the lines. Some slight difficulty was experienced with the draught, preventing her working at full steam. However, that has since been remedied with the most satisfactory result. The steamer behaved admirably, proving herself to be a good sea boat, and in every respect suitable for her work. The *Erwartung*, which is built of iron, to the design and under the direction of Mr. Alexander Murray, is 18,300 metres between perpendiculars, 4,300 moulded breadth, 1,700 moulded depth, and draws 1,515 aft, to enable her, when the deep sea fishing season is over, to take part in other work in the Frisches Haff. The steamer is rigged as a fore and aft schooner, and is fitted with all necessary appliances for towing ships and timber. During the fishing season she carries two large fishing skiffs of 22 ft. long on deck, which are used for baiting the hooks and taking in the fish. The machinery and boiler are placed amidships, with the coal bunkers arranged fore and aft on either side of the boiler. She has three complete bulkheads. The overhang of the counter is made long and broad for the easy working of the lines and nets, which are conveniently stowed in the after cabin, where also are arranged shelves for the fish, which can be packed on board ready for transmission by rail. Forward is a spacious cabin for the crew and fishermen fitted with all necessary conveniences. She has been supplied by her builder with a pair of compound surface condensing engines, designed by Mr. Charles King, to indicate 60 H.P. Diameter of cylinders 180 mm., 336 mm., and ?00 mm. stroke, working at a pressure of 10 atmospheres, and making 200 revolutions per minute. As yet no proper trial of speed has been made, owing to the quantity of ice floating about the harbour, but she is expected to make over 9 knots. She is the second addition to the salmon fishing fleet this winter, which now numbers five steamers, including one from Herrn Schichau, of Elbing, besides a few sailing boats.

A NEW P. AND O. STEAMSHIP.

ON Thursday, February 23rd, the largest steamship which has ever been constructed in Ireland—a vessel 466 ft. in length and of 6,380 tons gross register—was handed over by her builders, Messrs. Harland and Wolff, of Belfast, to the owners, the Peninsular and Oriental Steam Navigation Company. Her triple expansion engines indicate some 7,000 H.P., and she will be able to maintain 16 knots at sea. It will be seen therefore that the Admiralty knew what they were about when they selected her as one of the fast armed cruisers which they have subsidised the P. and O. Company to hold at the command of Government. The *Oceana* has been fitted under the superintendence of the Chief Constructor of the Navy with gun racers and other appliances, so that she could be equipped as a man-of-war on the shortest notice. She could carry 2,500 troops with ease.

It is, however, in the interests of peace and commerce that her main work is to be carried on, and she is destined to play an important part in the carrying trade between this country and the Australian colonies. She leaves London on the 9th of March with the colonial mails for Adelaide, and will proceed thence to Melbourne and Sydney, filled with a large number of first and second class passengers, for whose comfort luxurious provision has been made. Her dining saloons, her drawing room and smoking rooms, in light oak and in walnut, have all been designed by Mr. Colcutt, the architect of the Imperial Institute; and these, with the sleeping cabins, roomy and well ventilated, fitted with folding lavatories, with spring mattresses and chests of drawers, leave nothing to be desired. The creature comforts of the passengers have been well provided for by the refrigerating apparatus, which will not only provide the 250 first-class and 160 second-class passengers which she will carry with every imaginable dainty, but will serve to carry home frozen meat from the Colonies for the English market if occasion arises.

Messrs. Harland & Wolff have a sister ship nearly completed for the same company, named the *Arcadia*, to be employed in the same trade; and these, with the two equally large armed cruisers built at Greenock by Messrs. Caird & Co. (the *Victoria* and *Britannia*) will form four of the finest vessels in this great company's large fleet.

THE P. AND O. COMPANY.—At the present time the P. and O. Company owns 53 steamers, with an aggregate registered tonnage of 204,183 tons and 198,500 H.P., built at a cost of some £6,000,000, Their largest steamers are of 6,500 tons register, and the smallest 2,000 tons. In the course of the coming year no fewer than 200 of their steamers, of an aggregate tonnage of nearly 1,000,000 tons, will enter and leave the port of London alone. The steamers traverse 2,500,000 miles in the course of a year. The Company gives employment to 800 officers (commanders, officers, engineers, surgeons, &c.) of the mercantile marine, holding certificates from the Board of Trade, and a large proportion have her Majesty's commission in the Royal Naval Reserve. It has also in its service an army of nearly 15,000 people afloat and ashore. Great as are its resources and operations, the competition of the cheap class of cargo steamers with limited passenger accommodation which have lately been built has forced the company to extend its branches, and of late it has established a network of agencies throughout the country.

NAVAL ENGINEER APPOINTMENTS.

The following appointments have been made at the Admiralty from January 25th, 1888, to February 23rd, 1888:—

Allen, Joseph W., engineer to the *Daphne*, to date February 13.
Bray, William T., staff engineer to the *Inconstant*, to date February 10.
Cocks, Frederick A., chief engineer to the *Excellent*, additional, to date February 4.
Cooke, George H., chief engineer to the *Linnet*, re-appointed on promotion, to date January 10.
Coomber, Thomas G., chief engineer to the *Penguin*, re-appointed on promotion, to date January 10.
Crichton, Peter D., assistant engineer to the *Humber*, to date February 22.
Cummings, G. R. T., chief engineer to the *Espiègle*, re-appointed on promotion, to date February 1.
Davis, William H., staff engineer to the *Benbow*, to date January 25.
Garde, Robert P., assistant engineer to the *Impérieuse*, to date March 1.
Gorfett, George J., engineer to the *Porpoise*, to date February 15.
Harding, Charles A., engineer to the *Fearless*, to date March 1.
Hay, Charles J., assistant engineer to the *Impérieuse*, to date March 1.
Hornsby, R. S., engineer to the *Indus*, to date February 15.
Irish, H. W., acting assistant engineer to the *Crocodile*, to date February 1.
James, Charles J., assistant engineer to the *Fearless*, to date March 1.
Manning, Henry L., assistant engineer to the *Camperdown*, to date February 13.
Meadus, Harry H., engineer to the *Impérieuse*, to date March 1.
Metcalfe, Henry W., additional engineer to the *Impérieuse*, to date March 1.
Mitchell, John L., engineer to the *Stork*, to date February 14.
Nicklin, W., staff engineer to the *Excellent*, additional, to date February 4.
Richards, John A., assistant engineer to the *Shannon*, to date February 1.
Richardson, John, assistant engineer to the *Hecla*, to date February 14.
Rock, William B., chief engineer to the *Fearless*, to date March 1.
Siddorn, William, chief engineer to the *Excellent*, additional, to date Febrnary 4.
Snell, William, assistant engineer to the *Impérieuse*, to date March 1.
Snook, Victor E., additional engineer to the *Impérieuse*, to date March 1.
Spalding, A., staff engineer to the *Excellent*, additional to date, February 4.
Turner, William F., assistant engineer to the *Howe*, to date February 1.
Vining, Henry P., assistant engineer to the *Impérieuse*, to date March 1.
Watson, James H., assistant engineer to the *Trafalgar*, to date February 1.
West, Francis F., assistant engineer to the *Firebrand*, to date February 4.
Wheatley, George E., assistant engineer to the *Porpoise*, to date February 15.
Whittaker, Frederick G., staff engineer to the *Impérieuse*, to date March 1.
Willby, Richard D., chief engineer to the *Cordelia*, re-appointed on promotion, to date January 24.
Wilson, Alexander, fleet engineer to the *Hecla*, to date February 8.
Wingfield, H. E., chief engineer to the *Porpoise*, to date February 15.

THE GERMAN NAVY.—*The Swallow*, lately launched at the German Imperial dockyards at Wilhelmshaven, is a composite ship with twin engines of 1,500 H.P., driving two screws, which give a speed of 13½ knots per hour. Her length is about 203 ft.; breadth, 30 ft.; depth, 18 ft.; and tonnage, 1,300 tons. She is armed with eight long 4·13 in. Krupp guns, four firing in the direction of the keel, and the rest being revolving cannon. The vessel is not intended to take its place side by side with armoured vessels in the contingency of a naval war, but will be employed on foreign service, especially in cruising about the coasts of the German African colonies. Hardly ten months intervened between the laying of the keel and the launch of the ship.

SOUTH WALES TRADE NOTES.

Cardiff.—During the past four weeks the business done in the coal trade and the other staples of the district has been very satisfactory. The aggregate shipments of coal, foreign and coastwise, have been well above the average, and in almost every department of trade a buoyancy prevails, clearly indicative of confidence in the near future. Steam Coal.—At the time of writing the steam coal market is a shade easier than it has been for some weeks past. There is, however, no reason to fear that the lull will be anything more than temporary, and colliery proprietors are pretty hopeful that a large business will be done in this commodity before the close of the current week. The quotations have practically undergone no change; best qualities are very firm at 9s. to 9s. 3d., good dry coals 8s. 3d. to 8s. 6d., inferior sorts 8s. Small Steam has been very plentiful throughout the month in consequence of the dullness prevalent in the patent fuel trade. Prices have fluctuated between 3s. 6d. to 4s. 6d., and now good ordinary small can be purchased in any quantity at 3s. 6d. to 3s. 9d. House Coal.—The improvement in the house coal trade indicated in my last report has been fully maintained; all the collieries are fully employed, and fresh orders are daily coming into the market. No. 3 Rhondda (Large) has been quoted very firm, and selling very fairly at 8s. 3d., and there are many coal-owners who believe that should the present cold weather continue for any length of time the figure mentioned will be improved upon. Bituminous Coal is now very scarce, and during the month large prices have been asked for this commodity; its present market value is 6s. 8d. Patent Fuel.—In the early part of the month there was a slight spurt in the fuel trade, but unfortunately it was not long maintained, and at the present time the best brands for prompt shipment are quoted 8s. 6d., with 2½ per cent. off for cash. Coke.—During the month there has been a uniform enquiry for Welsh cokes; a very large business has been done at 14s. 9d. and 16s. 9d. for furnace and foundry respectively. Pitwood.—Notwithstanding the good demand for all classes of coal, Pitwood has materially fluctuated in prices during the past four weeks. The stocks on the wharves at present are very large; and as several fresh cargoes are due to arrive the quotations are weakening, the present values for good wood ranging from 13s. 3d. to 13s. 6d. Manufactured Iron and Steel.—There is practically no change in the condition of the iron and steel trade of the district; nearly all the works are busy. At Cyfarthfa and Dowlais the works are in full swing night and day. The following are the latest quotations:—Welsh bars, £4 12s. 6d. to £4 15s. 6d.; angles at the usual extras; sheet iron singles, £7 to £7 7s. 6d.; doubles and lattens at the usual extras f.o.t. at works; steel rails are quoted firm; heavy sections £4 to £4 5s.; light sections £4 12s. 6d. to £5 7s. 6d; Bessemer tin plate blooms £4 5s.; bars £4 15s.; Siemens steel bars £5 2s. 6d., less 2½ per cent. for cash. Freights.—The freight market throughout the month has been moderately active, and a considerable amount of chartering has been effected. Rates for most directions, however, in consequence of the quantity of tonnage on offer, has steadily weakened, more especially for the higher Mediterranean ports, the highest rate for Port Said being now 10s., quite a shilling per ton below the rate of the preceding month. Gibraltar, Spanish, and French ports are also weak, and the same remark applies to homeward business from the Spanish ore ports, the enquiry for tonnage from Carthagina, Huelva, and Bilbao being very limited. There has been a good enquiry for sail. Orders for this class of tonnage are coming into the market freely, and as a consequence rates have an upward tendency for most directions. Brazils and River plate freights are now quoted very firm, as are also Cape, West Indian, and South American. Rates coastwise and Mediterranean are, however, dull. A new industry will shortly be started in Cardiff, which will give employment to a large number of hands and materially improve the trade in the Glamorganshire Canal, Mr. William Butler, the proprietor of the well-known Crown Fuel Works, having acquired a large plot of land on the banks of the canal for the purpose of erecting works for the manufacture of household fuel. The machinery is already in a very forward state, and it is expected that the works will be in full operation in the course of a few months. At present it is intended that the make will be about a hundred tons per day, but this can be increased to two hundred tons if necessity should require it. Several other new industries are also freely spoken of in the district, but details are not yet ripe for publication.

The Barry Docks are now fast approaching completion, and it is expected that coal will be shipped from them before the close of the present year. The promoters of this undertaking represent some of the largest shippers from Cardiff, and fearing that the enterprise will materially affect the future trade of the parent port, the Bute Dock Authorities and the Taff Vale Railway Company are endeavouring to bring about an amalgamation of the two interests. Should this come to pass there is no doubt the facilities for the shipment of coal at Cardiff, and likewise that of the import trade, will be considerably improved, and the working expenses will also be materially reduced. Already, however, there has been considerable opposition to the scheme: and there is now a strong feeling that the better plan to adopt will be a working arrangement, by means of which the Taff Vale Railway Company will take over the management of the docks for a period of, say, from three to four years, and which will not necessitate parliamentary powers.

Swansea.—The prospects of the tin plate trade in its present condition is still being largely discussed in trade circles at this port. Contrary to all expectations, block tin has advanced, while tin plates on the contrary have receded. The demand for tin plates, however, has kept well up with the productions. On Change last Tuesday, 21st inst., a general opinion was expressed that the meeting of tin plate manufacturers recently held in Newport was not altogether satisfactory. Notwithstanding the fact the Monmouthshire makers are not yet prepared to join the combination in the precise form suggested. They have expressed their full accord with the object in view. Tin.—The values of block tin have varied very little during the past fortnight, the prices ranging from £166 5s. sharp cash to £167 10s.—the closing price, on the 21st inst., on Change being £167. Copper.—This market is a shade easier, the current quotations being £78. Pig iron.—Glasgow warrant market steady, 39s. 2d. and 39s. 4d. one month. Hematite.—Prices are unaltered, 42s. 6d. to 44s. The quotations for manufactured iron and steel are about the same as those given in the Cardiff market.—Tin plates: iron coke tins per box 1C, 14s. to 14s. 3d.; Bessemer steel cokes, 14s. 3d. to 14s. 6d.; Siemens (coke finish), 14s. 9d. to 15s.; ternes per double box, 28 by 20C, 24s. 6d. to 26s.; charcoal (Siemens steel) 15s. 6d. to 18s.; best charcoal, 18s. 6d. to 24s. 6d., according to finish and brand; wasters, 6d. to 1s. per box, less than primes —all delivered at Prince of Wales' Docks, Swansea, cash, less 3 and 1 per cent. The following are the latest quotations for the other staples of the district:—Anthracite coal: best big vein selected for malting purposes, 10s. 3d. to 10s. 6d.; ordinary large, 7s. to 9s., according to quality and selections; small rubbly culm, 4s. 3d. to 4s. 6d. per ton, all delivered f.o.b. Swansea, cash 30 days', less 2½ per cent. Steam coals.—Large 8s. to 9s. 6d., and bunkers 7s. to 8s., according to quantity; small, 4s. 6d. to 5s. 3d, per ton, delivered f.o.b. Swansea, cash 30 days, less 2½ per cent. Bituminous Coals.—Large, 9s. to 10s.; through coal, 7s. to 8s.; small, 5s. 6d. to 6s. 3d. per ton, delivered f.o.b. Swansea, cash 30 days', less 2½ per cent. Coke.—Best foundry, 15s. to 17s., and furnace, 12s. to 12s. 6d. per ton, f.o.b. Swansea, cash 30 days', less 2½ per cent. Iron ores.—Prices are unchanged, 12s. to 12s. 9d, per ton, nett ex-ship, cash 30 days', with an additional charge of 1s. to 1s. 6d. per ton for selected large.

Newport.—A buoyant and healthy tone pervades the market of this rapidly expanding district, and this has been the case throughout the month. There was a capital representative force of the various sections of the metal trades, as well as those intimately identified with the mining and shipping interests on Change, on the 22nd inst., and notwithstanding the various, as yet, unsolved problems connected with the metal trades, more especially the tin plate trade, as a result of the fluctuations in prices which almost daily evidence themselves in the raw material, as well as the divergent views which the makers of South Wales and Monmouthshire entertain as to the character of the special combinations, which ought, in the opinion of both sections, to be organised in the protection of their mutual interests, the following are the latest quotations:—Steam coal, best qualities, 7s. 6d. to 7s. 9d.; seconds, 7s. 3d. to 7s. 6d.; screenings, 4s. 3d. to 4s. 6d., with a fair demand for all descriptions. House coal.—Best qualities, 9s. 3d. to 9s. 9d.; Smith's coal, 5s. 3d. to 5s. 9d. Pig iron.—Glasgow warrant closing sellers, 39s. 3d. cash, London quotations ruling here; hematite, closing sellers, 42s. cash; Middlesboro' and Cleveland, No. 3, 31s. 6d. f.o.b. prompt; other numbers in proportion. Iron.—Welsh bars, £4 10s. to £4 12s. 6d.; sheet iron, singles, £7 to £7 2s. 6d., f.o.b. at works. Steel.—Heavy sections, steel rails, £4 to £4 5s.; light sections, £4 12s. 6d. to £5 7s. 6d. f.o.b.; ties, sleepers, angles, channels, &c., according to specification and guage. Steel sheets.—Singles, £7 10s. to £8 15s., with usual extras for higher gauges; Bessemer steel tin plate blooms £4 5s., bars, £4 16s. 9d.; Siemens' tin plate, bars (best), £5 2s. 6d. per ton, Welsh ports, less usual percentage for cash. Iron ore, 11s. 9d. Freights are easier all round.

INDUSTRIAL NOTES.

THE CLYDE AND EAST OF SCOTLAND.

THE month of February has not been marked by anything like the same plenitude of fresh orders for shipbuilders and engineers which had characterised the previous few months. Indeed, scarcely any order of importance has been received, but the work which has lately come to the Clyde has been so well distributed over the various builders that few are found complaining of the paucity of fresh orders. What many of them complain of is a wretchedly bad delivery of material from the manufacturers, and in some instances the wages disputes with their workmen. It would seem that those builders are best supplied with material whose orders have been booked most recently—probably on account of the more favourable terms the manufacturers have been able to procure from them since the advance in shipbuilders' prices.

Messrs. Fleming & Ferguson, shipbuilders, Paisley, have been instructed by the contractor who is making the Manchester Ship Canal, to build a dredger which will raise 600 tons per hour. The engines will be on the quadruple expansion principle, and indicate 700 H.P. The same firm has received an order from Mr. Sholto D. C. Douglas, of Douglas Estate, Coatbridge, to build a 40 ton steel steam yacht, which will be supplied with the builder's patent quadruple expansion engines.

Messrs. A. A. Laird & Co., of the Glasgow, Dublin, and Londonderry Steam Packet Company, have arranged for the building of a steel screw steamer of 600 tons gross for the Glasgow and North of Ireland passenger service. The vessel, which is to be somewhat similar to the *Elm*, owned by the same steam-packet company, is to be supplied with triple expansion engines by Messrs. Lees, Anderson & Co., engineers, Anderston, Glasgow; but the hull will be constructed by Mr. Chas. C. Biggar, of the Foyle Shipbuilding Yard, Londonderry.

Most of the shipbuilding yards at Port Glasgow have a good amount of work on hand. Messrs. Russell & Co. have on their stocks in their Kingston yard, as many as five vessels of a total of 11,200 tons, three being steamers and two sailing ships. The same firm in their East End yard have three vessels of about 4,300 tons. Messrs. Robert Duncan & Co. have four vessels of an aggregate of 6,500 tons, the vessel last ordered being a sailing ship of 1,500 tons for Glasgow owners. Messrs. Hamilton and Co. have on hand a screw steamer of 2,500 tons, Messrs. Murdoch and Murray a screw steamer of the same dimensions, and Messrs. Reid & Co. a steamer of about 1,600 tons. Messrs. D. J. Dunlop & Co. have two vessels on hand at present, and have some orders for the construction of engines. During the month two launches took place from Port Glasgow yards. Messrs. Robert Duncan & Co. launched a twin screw tug (the *Flying Cormorant*) for the Clyde Shipping Company; and Messrs. Russell and Co. an iron sailing ship, named the *Sutlej*, of 1,660 tons, for Messrs. Foley, Aikman & Co., London. Messrs. Russell & Co. have now completed work on the two oil-carrying steamers, the construction of which unique vessels has proved a somewhat difficult undertaking. The trial trip of the last of these vessels took place on the 24th ult. Altogether the prospect of work in the shipbuilding and engineering trades has not been so good in Port Glasgow for some considerable time.

At Dumbarton and Clydebank (the two principal firms of these districts), Messrs. Denny Brothers and J. & G. Thomson are each busily employed, the former with the fast paddle steamer for Channel service between Dover and Ostend, and the two large steel screw steamers for the Campania Transatlantica of Barcelona, and the latter with the two highly important Inman liners. The engine works of Denny & Co., Dumbarton, are fully occupied, most of the engines on hand being of the quadruple expansion type, patented by Mr. Walter Brock, of that company. Very

successful trials have just been made with the *Phœnician* of the Allan line, whose machinery has been converted from the ordinary compound to the quadruple type. The firm have also on hand several sets of quadruple paddle engines, on Mr. Brock's patent tystem, the success of which is now assured for purposes of river sraffic also, as two paddle steamers fitted with this type of machinery have now been for some time working on the Irrawaddy river with most markedly successful results, both in efficiency and economy.

The proposal to erect a memorial to the late William Denny, the eminent shipbuilder of Dumbarton, is meeting with hearty support. The subscriptions, which now total £2,675, have not alone a local origin, but are received from friends and admirers of the deceased gentleman all over the world.

Mr. G. L. Watson, yacht designer, has just placed four contracts on the Clyde for four yachts of varied design—the largest one to be built by Messrs. D. & W. Henderson & Co., Partick, and will be in many respects similar to the *Thistle*, having the same large overhang on stem and stern, and the same large sail area. She will be a composite instead of a steel yacht, as was the case with last year's British competitor for the American Cup. Messrs. W. Fyfe & Son, Fairlie, are to build two of the others. The outstanding feature in the case of one of them will be that she is to be a centre-board craft. She will be one of the first, if not the first, of the type built on the Clyde, and will therefore have a great attraction for Clyde yachtsmen. The yacht is for shallow waters, and this is said to be the cause of the centre-board being adopted. The fourth yacht is to be built by the Ailsa Shipbuilding Company, Troon.

At Dundee the shipyards are fairly well employed. Messrs. W. B. Thomson & Co. have two vessels on the stocks, and from inquiries that are being made they are hopeful of receiving other orders. At the annual meeting of the shareholders of this company held recently, Mr. W. B. Thomson, managing director, said that the company had been on the Admiralty list for some time, but from competition and other causes they had not yet secured a Government contract of any consequence. He did not think that Glasgow and other ports should get all the work, to the exclusion of Dundee, which was a town of considerable importance, and was always increasing in this respect.

The shipbuilding yards Nos. 10, 12 and 14, at Perth Harbour were let towards the end of last month on twenty years' lease to Messrs. Calder & Co., wood merchants, Glasgow.

The patent unsinkable semi-collapsible lifeboat invented and recently patented by Mr. Robt. Chambers, late shipbuilder at Dumbarton, seems to be meeting with considerable favour from shipowners. A number of the boats have been placed on board the ss. *City of Berlin*, of the Inman and International line, and an order has recently been received for ten to be supplied to two vessels building on the Mersey for the Argentine Republic. More orders are expected to follow, and there is also a likelihood of the inventor receiving financial support sufficient to commence factories for making the boats in large numbers. Mr. Chambers has already leased works at Dumbarton (formerly the Woodside sawmills and joiner works), and here he purposes to commence operations at once.

The subject of lifeboats for ships has a strong attraction for the inventor, and it is well for the general public and for those who "go down to the sea in ships" that it should be so. Within the past few days two inventions connected with the operation of lowering and disengaging boats at sea have been exhibited in the Glasgow Royal Exchange. One was of W. Keir Confer's patent for lowering the davit outwards, so that the lifeboat may be placed in the water a sufficient distance from the ship to prevent her being stove in by the rolling or pitching of the vessel. The other was the apparatus patented by Captain Macpherson, of the Clyde river steamers, for launching, lowering, and disengaging ships' boats. Several years ago Captain Macpherson patented his ideas, which were then tested and recognised as being at least partially successful; but since that time he has been dilligently thinking out improvements, with the view of perfecting his patent, and practical men who have already seen the present model working are satisfied with its complete success.

The buildings and internal arrangements of the forthcoming International Exhibition are progressing in a uniformly rapid manner, and on all sides encouraging testimony is being received of the ultimate success of the undertaking. In the machinery section, between 300 and 400 spaces have been allocated to different exhibitors. Messrs. Alley & M'Lellan, Polmadie, and Messrs. John Cochrane & Co., Barrhead, are presently preparing to fit up four powerful engines, which will form the motive power for the many exhibits.

TRADE NOTES FROM THE TYNE, WEAR, &c.

The Tyne.—Among recent important shipbuilding orders secured on the Tyne is one for a vessel to be over 400 ft. long, obtained by Messrs. S. Stephenson & Co., from Messrs. Wilson, of Hull. Messrs. Stephenson have just commenced the construction of two lightships, ordered by the Trinity House, and they are now preparing for opening early in March the extensive new boiler works which have been erected in proximity to the shipbuilding works. Messrs. W. Richardson & Co., are preparing for launching an exceptionally large vessel which has stood on their stocks for nearly three years. Owing to the collapse of the company, by whom it was originally ordered, it was thrown one he builders' hands, but a purchaser has been found, and it ist understood that the vessel will, when ready, be employed in the Atlantic passenger trade. Two first class steamers recently launched by Messrs. Hawthorn, Leslie & Co., have also changed hands, one having been acquired by an Italian shipowning company, and the other having been added to the merchant fleet of Russia. The firm are now completing the fittings of these steamers, and are also putting the finishing touches to the Brazilian Mail steamer *Alagoas*, which is said to be one of the most elaborately fitted up vessels that have ever been built on the Tyne. As indicated in last month's report, the firm have several large vessels in early stages, but the non-delivery of material continues to hinder operations. As an instance of the hindrance to progress in Tyne shipyards from this cause, it may be mentioned that a vessel's frames, which ought to have been delivered to Messrs. Wood & Skinner in the second week of January, only began to arrive in the last week of February, the result being that the first stage of the vessel's construction could not be commenced till the latter period. This vessel, it may be stated, is ordered by a Swedish firm, and is to have a carrying capacity of nearly 3,000 tons. Messrs. Armstrong, Mitchell & Co. have at present more than half their berths empty at their Low Walker Yard. The vessels that are on the stocks, however (four in number), are of large tonnage, and there are others to follow. Messrs. Dobson and Co. have now more work on the stocks than they have had since the opening of their yard some five years ago. This is one of the comparatively young firms which seems to be able to compete on something like equal terms with its older neighbours. Messrs. Palmer are preparing to re-open their yard at Howdon, which has been closed since 1884. The output of tonnage by this great firm in the current year will probably come near equalling the unprecedentedly large production of 1883. The Tyne Shipbuilding Company will also be able to show an excellent record for this year, the four vessels now in hand being of themselves sufficient to constitute a good twelve months' production. Messrs. C. S. Swan & Hunter are now extremely busy, and daily additions are being made to the staff of hands employed. Every repairing establishment on the river has more or less work in hand, and some of them are exceedingly busy. With reference to the marine engineering establishments, there is little that is new to be said, a brisk state of business being the feature in every instance. The works which are devoted to the manufacture of steam winches, steering gears, &c., continue to develope increased activity; and chief among these may be mentioned the establishments of Messrs. Emmerson, Walker, and Thompson Brothers, Dunston, Messrs. Clark, Chapman and Parsons, Gateshead, and Messrs. Donkin & Nichol, Newcastle. The special pumps manufactured by Messrs. H. Watson & Sons, High Bridge, Newcastle, for use in steam ships, are in great demand, and inquiries in respect of other important specialities manufactured by this firm continue numerous. The Tyne boiler works, Low Walker, are pressed with orders just now for boilers of both the marine and stationary types, and the Beverly boiler Works, Gateshead (Messrs. E. T. Joicey & Co.), are also kept briskly going on orders for a special type of boiler that has been patented by the principal partner in the firm. Messrs. M'Arthur, Dixon & Co., Wallsend, have just supplied one of their patent angle bevelling machines to Mr. Laing, of Sunderland, and they have orders to supply machines of the same description to one of Her Majesty's dockyards, and to the Low Walker yard of Messrs. Armstrong, Mitchell & Co. The last named firm have had two of the machines in use at their Elswick yard for some time past, and the fact that they are now about to introduce them at their Low Walker establishment, must be regarded as a high testimony to their value. Messrs. Hawks, Crawshay & Sons' new steel works will be put in operation early in March, and the additional furnaces which are being erected in connection with the Jarrow

Steel Works, are expected to be ready for starting by the end of April. The manufacturers of steel and iron sheets have their hands full just now, and in some instances extensions of premises are spoken of. At the local rolling mills business is also much improved.

The Wear.—The unfavourable weather and the difficulty of procuring material now constitute the two great impediments to activity in the shipbuilding yards. A good many important orders have been secured, and, if it was not for the causes named, some resemblance to the normal state of business would by this time have been reached. Messrs. R. Thompson and Sons have sold to a Japanese firm a splendid steamer, which was built by them on the speculative principle, and the vessel, which was launched on February 13th, is now being fitted with triple expansion engines by Mr. John Dickinson. Messrs. Thompson have another large vessel in the framing stage, and they have usually one or more repair contracts in hand. Messrs. J. L. Thompson and Sons are putting up additional machinery in their North Sands yard, and also at their Manor's Quay Repairing Works. They have at present four important repair contracts in hand, in addition to the largest show of new work to be seen at any shipyard in the North. Messrs. Pickersgill, having obtained an order for a vessel to be employed in the China trade, have put their frame turners on night shift. The firm have also a large vessel in the framing stage. Messrs. Bartram and Haswell are plating a large vessel ordered by a local company, and they have just commenced the framework of a vessel, which is also to be built on local account. The Sunderland Shipbuilding Company are repairing the steamer *Pinnas*, which was lately sunk at the entrance to the river, and Messrs. Short Brothers are overhauling the s.s. *Saltburn*, which was under water some days at the same place. Both the last named firms have an abundance of new work in hand. At the Deptford yard, a fine vessel, named the *Ville de Belfort*, was launched about the middle of the month, and the keel for another vessel of large size has since been placed in the vacated berth. Messrs. S. P. Austin and Sons have sold to a Leith firm a large steamer which was put down on "spec" in July or August last year. The firm are preparing to launch a large sailing ship. It is now known that Messrs. W. Doxford and Sons have at least five vessels to build, and the fear which existed some time ago that this old established firm was not likely to participate in the general improvement is found to be groundless. The marine engineering establishments on the Wear remain very busy. In every instance orders have accumulated to an extent unknown for several years, and all available resources are being utilized to the very fullest extent. Mr. John Dickinson is putting a four-cylinder engine in the s.s. *James Drake*. This is, of course, a renewal contract, and the result of substituting a four-cylinder engine for an old type surface condensing one will be watched with considerable interest. Mr. A. A. Rickaby, of the Bloomfield Engine Works, Monkwearmouth, continues to receive numerous inquiries for his specialities, and his establishment is kept in active operation. Messrs. C. & M. Douglas are doing a steady business at their Bedford Street and Low Quay Engine Works, and the various engine and boiler works at Pallion, including Messrs. John Lynn & Co., Messrs. Welford, Brothers, and Messrs. Irving & Joplings, continue to be kept briskly going. In the foundries there is an almost unprecedented pressure of work, and the whole of the forges are now in operation, with the exception of the Trimdon St. Forge and the King's Forge, Pallion. The latter establishment is now for sale, and, being admirably arranged for the turning out of heavy forgings used in shipbuilding and marine engine building, is not likely to remain long without a purchaser. At Messrs. S. Tyzack & Co.'s works the state of business has much improved in both the iron manufacturing and rivet making departments. Henderson's patent self-cleaning furnaces have just been fitted to the boilers of the s.s. *Diligent*, recently launched by Messrs. Short Brothers, and engined by Mr. John Dickinson. The fitting of the furnaces has been carried out by Messrs. Readhead and Ingram, the agents for Sunderland and district.

The Hartlepools.—At Messrs. W. Gray & Co.'s yard the whole of the berths are occupied, and the frame furnaces are kept going night and day. At Messrs. Withey's establishment there is also a full supply of work, and Messrs. Irvine & Co. have orders to proceed with. The marine engine works continue very brisk, and the operations for altering the West Hartlepool iron works, to fit them for the manufacture of steel, are being energetically carried out.

The Tees.—The yard at Stockton which formerly belonged to Messrs. Pearse and Co. is now under new proprietorship, and it is expected that in a short time some important contracts will be put in execution. The yards of Messrs. Richardson and Duck and Messrs. Craig, Taylor and Co. are well supplied with work, and on the whole shipbuilding prospects at this centre are most encouraging. Exceptional briskness continues to be the feature at Messrs. Raylton, Dixon and Co.'s yard, and the marine engine works of Messrs. Westgarth and English and Messrs. Blair and Co. continue in full activity. Forges, foundries, and other establishments of a kindred character, are all showing improvement.

HOAR & BROWN'S TEAK MARKET REPORT.

Teak.—The market has still an upward tendency, and shippers' prices are considerably higher, both for cargoes afloat and for stock here.

The deliveries from the docks during last month were 1,731 loads, as against 432 loads last year, and 864 loads in 1886.

This is an extraordinary increase, and tends to show that consumers have been anxious to cover their contracts before a further rise.

In acting thus, wisdom has been shown, and we would strongly recommend those who have not bought to do so, rather than hope for a fall in prices.

The following figures may be of interest, and serve to substantiate the above remarks.

The stock of Teak in the docks on the 28th January was 9,289 loads, as against 14,832 loads in 1887. This is the first time since January, 1886 (two years ago), that the stock has been so small. The deliveries for the past four months (viz., October, November, December, and January) have been no less than 6,288 loads, or more than half the total deliveries for the whole year of 1887.

Teak planks are also firm for retail quantities, but prices asked by the shippers are unwarrantably high; and until they become more reasonable, no wholesale business can be done.

As the season advances the importation of this article is likely to be a heavy one. The stock is 700 loads, against 1,760 loads last year.

Mahogany.—Since the date of our last circular there has been an extraordinary advance in values for all kinds, the small and medium being especially in demand, and the minimum being now at a higher point than we have seen for several years. The prospective supplies being moderate, not to say limited, there is every prospect of a further improvement in price.

The deliveries and stock are as follows:—

	Deliveries.		Stock, 31/1/88.		Stock, 31/1/87.
Honduras ..	1,160 logs,	leaving	2,250,	compared with	3,503
Mexican ..	789 ,,	,,	2,258	,, ,,	4,594
Cuba	55 ,,	,,	204	,, ,,	2,564

Since this stock-taking there has been landed 739 logs Honduras and 197 logs Mexican.

The above figures are very startling, and should the large deliveries continue there is no knowing where prices will reach, as our advices from abroad point to a very small supply for some months.

LAUNCHES AND TRIAL TRIPS.

LAUNCHES.—English.

C. A. Bade.—On January 28th there was launched from the yard of the Sunderland Shipbuilding Co., a steel screw steamer, built to the order of Messrs. Leech, Harrison & Forwood, of Liverpool, of the following dimensions and particulars:—Length, 170 ft.; breadth, 26 ft. 3 in.; depth of hold, 12 ft. 6 in.; classed 100 A1 at Lloyd's, under special survey, having long full poop and bridge combined, and topgallant forecastle. The steamer, when finished, will be handsomely fitted up amidships for captain and officers, and a few passengers, the crew being berthed in topgallant forecastle. The steamer is fitted with steam winches, by Messrs. Welford Bros., and patent windlass by Messrs. Emmerson, Walker & Co., and all recent improvements. The main engines are on the three crank, triple-compound principle, by the North Eastern Marine Engineering Company, Limited, having cylinders 14 in., 23 in., and 39 in. diameter, by 27 in. stroke; working pressure, 160 lbs. per square inch. Upon leaving the ways the vessel was named *C. A. Bade*, by Miss Hands, of Sunderland.

Port Caroline.—On January 28th the *Port Caroline*, a steel screw steamer of the clipper stem type, was set afloat from the yard of Messrs. R. & W. Hawthorn, Leslie & Co., Hebburn. The vessel, which is built to the highest class at Lloyd's, is intended for the London and Australian passenger trade. The dimensions of the vessel are as follows:—Length, 380 ft.; breadth, 42 ft.; depth, 29 ft. 6 in. The *Port Caroline* has three decks, poop, and forecastle, and a fine cutwater and figurehead. She is the sister ship to the *Port Denison*, which has just completed her maiden voyage from London to Australia and back. Mrs. Milburn performed the christening ceremony as the vessel was leaving the ways.

Diligent.—On January 30th, Messrs. Short Bros. launched from their yard at Pallion, Sunderland, a steel screw steamer, built to the order of Mr. James Westoll, of Sunderland, of the following dimensions:—Length, 292 ft. 6 in.; breadth, 39 ft.; and 21 ft. 2 in. depth moulded. The vessel, which is built of Siemens-Martin steel throughout, is constructed to the highest class in Lloyd's Register under special survey, on the web-frame principle, and has a short poop aft, with long raised quarter-deck adjoining long bridge-house amidships, the latter being extended before the foremast and topgallant forecastle. The accommodation for crew is in the fore end of the bridge-house. The double bottom for water ballast is constructed on the cellular principle, divided for trimming purposes. The cargo holds are four in number, divided by watertight bulkheads. The vessel is fitted with all the latest improvements for despatch in loading and discharging cargo. On leaving the ways she was named the *Diligent*, the ceremony being performed by Mrs. J. T. Mail, of Sunderland. The vessel is to be fitted with engines and boilers of 180 H.P. by Mr. John Dickinson, Sunderland, on the triple-expansion principle, having three cranks, the boilers having a working pressure of 150 lbs., and all modern improvements in marine engineering, and patent steam windlass by Emerson, Walker & Co., of London.

Trelawny.—On January 30th there was launched from the shipbuilding yard of Messrs. John Readhead & Co., West Docks, South Shields, a steel screw steamer of the following dimensions, viz.:—259 ft. by 36 ft. by 19 ft. The vessel has been built to class 100 A1 at Lloyd's, is of the improved well-decked type, and has water ballast on the cellular bottom principle. The engines are triple-expansion, having cylinders 20½ in., 33½ in., and 55 in. by 36 in. stroke, and working at a pressure of 160 lbs. The hull and machinery are fitted with all the latest improvements for securing economy and despatch. The vessel has been built to the order of Messrs. Edward Hain & Son, St. Ives, Cornwall, is named the *Trelawny*, and is the fifteenth vessel built by Messrs. J. Readhead and Co. for Messrs. E. Hain & Son.

Chia Shih.—On January 31st there was launched from the yard of Messrs. R. & W. Hawthorn, Leslie & Co. (Limited), Newcastle-on-Tyne, the first of two steel twin screw steamers, building by them for the Royal mail and passenger service of the Chinese Government. The dimensions of the vessels are:—Length 260 ft.; breadth 34 ft.; depth 19 ft. The vessel is built to the highest class at Lloyd's, with deck-house, for the accommodation of passengers, from the after-end of forecastle to the stern. Over the house is an awning deck, extending the full width of the ship, and of the same length as the house. Forward of engine and boiler space, in the large deck-house before mentioned, is a saloon for first-class European passengers, together with the necessary state rooms, lavatory arrangements, &c. On each side of the engine and boiler hatches are the officers' and engineers' cabin. Abaft the engine-room, also in this house, is the accommodation for first-class Chinese passengers. On the awning deck forward is the chart-house, wheel-house, captain's cabin, &c., together with the entrance house to European quarters. In the 'tween decks forward is accommodation for the Chinese second-class passengers, and in the 'tween deck abaft the engine-room for the third-class Chinese. The vessel throughout will be lighted by the electric light, including masthead, side lights, cargo lamps, &c., which is being supplied by the Woodside Electric Light Company, of Glasgow. The vessel has steam windlass and steam winches by Messrs. Clarke, Chapman, Parsons & Co., and also steam steering gear. The vessel will be driven by two sets of triple-expansion engines, having all the latest improvements, including Marshall's valve gear, &c. There will be two multitubular double-ended boilers, which will be fitted with forced draught, and worked at a pressure of 160 lbs. These vessels are being built under the supervision of Messrs. A. & W. Dudgeon and Mr. Cromarty, who are acting on behalf of the Chinese Government. The vessel was named the *Chia Shih* by Mrs. Frank Marshall, of Tynemouth.

Rufford Hall.—On January 31st there was launched from the shipbuilding yard of Palmer's Shipbuilding and Iron Co., Limited, Jarrow, a steel screw passenger steamer intended for the India and general trades, and is a sister ship to the *Locksley Hall* and *Branksome Hall*, recently built, these three vessels being built for the Hall Line, managed by Messrs. Robert Alexander & Co., of Liverpool. The description is as follows, viz.:—Length between perpendiculars, 380 ft.; breadth moulded, 45 ft.; depth, 30 ft. 3 in.; depth of hold, 27 ft. 6 in. She will carry 6,000 tons deadweight on a moderate draught, has been built of special strength beyond what is required by Lloyd's for the three-deck class, and has cellular double bottom throughout. There is a long promenade deck amidships, with accommodation for 70 passengers, and a large dining saloon at fore end extending the full width of ship. A large teak deck-house encloses saloon entrance, ladies' room, smoke-room, and chart-house; the whole being fitted up in a most complete style. There will be a long poop fitted for the accommodation of the second-class passengers at fore end, and crew at after end, topgallant forecastle with direct steam windlass under, and double warping capstans on top, arranged to work together or independently. The boats for this steamer, and also those for the *Branksome Hall* and the *Locksley Hall*, were supplied by Mr. W. H. Wake, of the Low Quay Boat Works, Sunderland. The electric light will be fitted in saloon, state-rooms, engineers' and officers' berths. The vessel will be propelled by a set of triple-expansion engines also constructed by the Palmer's Company. They will have cylinders 29 in., 47 in., and 76 in. diameter, with a stroke of 51 in., and indicate 3,000 H.P. Steam will be supplied by two extra large double-ended boilers, constructed of steel, for a working pressure of 150 lbs. per square inch. She will be supplied with six powerful winches and a large donkey boiler for driving these and other auxiliary engines. The vessel, on leaving the ways, was christened the *Rufford Hall* by the Mayoress of Jarrow (Miss Price), daughter of John Price, Esq., J.P., general manager of the company.

Urania.—On January 31st Messrs. W. Gray & Co. launched a fine screw steamer, of the following dimensions:—Length overall, 310 ft. by 38 ft. 6 in. by 23 ft. 3 in. moulded, to carry over 3,800 tons, built to the order of Messrs. Gladstone & Cornforth, of West Hartlepool, and classed 100 A1 at Lloyd's. The vessel is of the well decked type, with poop aft, containing saloon and cabins for officers and a few passengers, long raised quarterdeck, long bridge of extra strength right up to fore hatch, and containing comfortable quarters for the crew. The usual topgallant forecastle is fitted forward with Emmerson, Walker & Co.'s windlass. The hull is built on the web frame principle, dispensing with hold beams, and giving a clear hold for working cargo. Five hatches are fitted, four steam winches, steam steering gear, and two donkey boilers, water ballast in double bottom, under each hold. The vessel will, in every respect, be well equipped for general trading. The engines, which are on the three cylinder triple-expansion principle, are being supplied by the Central Marine Engineering Company, of West Hartlepool. The engines will be of over 1,000 H.P., with steel boilers to work at 160 lbs. pressure, and give an ample supply of steam. The christening ceremony was gracefully performed by Miss H. Clark, of West Hartlepool, the vessel being named *Urania*.

Paula.—On February 3rd there was launched from the Low Walker Shipbuilding yard of Messrs. Sir W. G. Armstrong, Mitchell & Co., a steel screw steamer, intended for the Atlantic petroleum trade between the United States and Hamburg. The vessel is named the *Paula*, and is capable of carrying 3,400 tons of oil, besides fuel; and her bunkers are so arranged that she can take a sufficient quantity for both outward and homeward voyages. This is the seventh vessel that Messrs. Armstrong, Mitchell & Co., have built for the Atlantic petroleum trade.

Merida.—On February 10th Messrs. Edward Withy & Co. launched from their shipbuilding works at Hartlepool, before a large concourse of people, a screw steamer, built to the order of Messrs. H. Bucknall & Sons, of London. The vessel is a fine type of a modern cargo boat, and is built of Siemens-Martin steel. She is over 300 ft. in length, with a large measurement and deadweight carrying capacity, and built to the 100A1 class under special survey at Lloyd's. The vessel has a long raised quarterdeck, short poop, and long bridge house, with a topgallant forecastle. For extra strength, and in order that the vessel may be economically kept up, all decks, deck erections, skylights, bulwarks, rails, bulkheads, &c., are built of iron or steel. She has very large hatchways, with an extra number of winches, and the warping arrangements are most complete. In the main and afterholds she is built on the web frame system, which gives a very strong type

of ship, and dispenses with all hold beams, thus enabling the vessel to carry cargoes of the most bulky description, such as machinery, torpedo boats, large guns, &c. She has a cellular bottom all fore and aft (Withy & Sivewright's patent), and the afterpeak will also be available as a ballast tank. Nearly all the shell plates are in 24 ft. lengths, making the structure of the ship very strong. She will have a patent windlass on the forecastle deck, and is fitted with patent stockless anchors, hauling up into hawse pipes, dispensing with davits, cranes, &c. Two donkey boilers are fitted in the fore end of the boiler room, hand and steam-steering gear amidships, with patent standby screw gear aft. The accommodation for the officers, passengers, &c., is under the poop aft, and fitted up in hardwood, with beautifully hand-painted panels by the lady decorative staff of the firm. The vessel is rigged as a two-masted fore and aft schooner, having iron masts, and with squaresail on foremast. She will be fitted with triple-expansion engines by Messrs. Blair & Co., Limited, of Stockton-on-Tees, whose engines are well known for their economical working. The vessel and engines have been built under the superintendence of Mr. H. A. B. Cole, M.I.N.A., of London. On leaving the ways the vessel was gracefully christened *Merida* by Miss McKinlay, of Hartlepool.

Muke Maru.—On February 13th there was successfully launched from Messrs. Robert Thompson & Sons, Southwick Yard, a steel screw steamer for the Nippon Yusen Kaisha Steamship Co., of Tokio, Japan. The following are her dimensions:—Length, 331½ ft.; breadth, 42 ft.; depth, 28¾ ft. Built to Class 100 A1 at Lloyd's under special survey. The vessel has cellular double bottom for water ballast, 6 bulkheads, 4 large hatchways with cargo ports, 4 horizontal steam winches and donkey boiler, Clarke, Chapman, Parsons & Co.'s patent windlass and steam steering gear, large house on deck aft for captain and passengers, protected by a neat cape covering stern, bridge amidships, 70 ft. long, for accommodation of officers and engineers, and large topgallant forecastle for crew. The engines are by John Dickinson, Esq., Monkwearmouth, and will indicate about 1,400 H.P., capable of driving her 10½ knots, and she has extra large boilers.

Pallas.—On February 13th Messrs. Raylton Dixon & Co., of Middlesbrough, launched a very handsome screw steamer, which has been built to the order of Messrs. Rathbone Brothers & Co., of Liverpool, for their "Star Line" of Calcutta steamers. The dimensions of this vessel are:—Length, 352 ft.; breadth, 42 ft. 2 in.; depth, 28 ft. 9 in. She has a deadweight capacity of 4,500 tons, and is a very handsome model, being built on fine lines, to maintain a high speed, and will be fitted with very complete accommodation for about 36 first-class passengers in house on deck, saloon being panelled entirely in marble, and the vessel lighted throughout with the electric light. Her engines will be fitted by Mr. George Clark, of Sunderland, the cylinders being 28 in., 44 in., and 72 in. diameter, with a stroke of 42 in., and a working pressure of 160 lbs. The launch was witnessed by Mr. Brown, chairman of the Star Company, Mr. Ashton Rathbone, of Liverpool, and Captain Peel, the superintendent of the company. The vessel on leaving the ways was christened the *Pallas* by Miss Inga Raylton Dixon, the youngest daughter of the builder.

LAUNCHES—Scotch.

Flying Cormorant.—On January 28th Messrs. Robert Duncan & Co. launched from their shipbuilding yard at Port Glasgow, a steel twin-screw tug steamer, named the *Flying Cormorant*. The following are her dimensions:—Length, 135 ft.; breadth, 24 ft.; depth, 12 ft. This vessel has been built as an addition to the towing fleet of the Clyde Shipping Company, Glasgow, and will be furnished by Rankin & Blackmore, Greenock, with a pair of Rankin's patent twin-screw disconnecting engines.

Taroba.—On January 31st Messrs. A. & J. Inglis launched from their shipbuilding yard at Pointhouse, Glasgow, a screw steamer named *Taroba*, built of steel, to the highest class at Lloyd's. Her dimensions are:—110 ft. long, 46 ft. beam, and 31 ft. deep, the tonnage being about 5,000. Accommodation has been provided for a large number of passengers, and the saloons and state rooms fitted with every recent invention, including electric light. The equipments for loading and discharging cargo are also a feature of the vessel, powerful hydraulic gear being supplied. The engines, which are to be of the triple-expansion type, will indicate 5,000 H.P.

Strathearn.—On February 1st, the already fine fleet of vessels owned by Messrs. Burrell & Son, Glasgow, received an important addition by the launch of a beautifully modelled screw steamer, built by Messrs. Alexander Stephen & Sons, Linthouse, to their order. Among those present at the launch were Sir John Neilson Cuthbertson, Miss Cuthbertson, Mr. and Mrs. Andrew Watson, Mr. and Miss Robertson, Mr. and Mrs. Stephen, Mrs. Burrell, Mrs. Darland, Mr. and Mrs. John Phillips, Mrs. Wilson, Miss Stewart, Mr. and Mrs. Watt, Mr. John Murray, Mr. Keith, Mr. William Campbell, Mr. and Mrs. Alexander Gillespie, Mr. and Mrs. George Burrell, Mrs. McKing, Mr. James Young, Mr. Mitchell, and the members of the builders' firm. The steamer was gracefully named the *Strathearn*, by Miss Cuthbertson. The *Strathearn* is a steel steamer of about 4,300 tons deadweight carrying capacity, and class 100 A1 in Lloyd's; built in excess of Lloyd's requirements, and including the bulkheads, &c., fitting her for being placed on the Admiralty list as eligible for transport service. She has a full poop, a long bridge extending over engine and boiler space, and containing accommodation for captain, officers, and a few first class passengers, topgallant forecastle for crew, teak decks, cellular double bottom for water ballast, and all the best modern appliances for comfort, safety, and efficiency. Her engines are on the triple-expansion principle, with cylinders 23 in., 37 in., and 59 in. diameter, by 42 in. stroke, and a working pressure of 160 lbs. She is also fitted with Napier's independent steam windlass, Muir & Caldwell's steam steering gear, and five steam winches. She was launched with machinery on board, and ready for sea in a few days.

Choy Sang.—On February 11th there was launched from the building yard of Messrs. Hall, Russell & Co., Aberdeen, a steel screw steamer named *Choy Sang*, of the following dimensions:—Length over all, 270 ft.; breadth, 35 ft.; depth, 25 ft. 6 in.; and 1,900 tons gross register. This vessel has been built under special survey to class 100 A at Lloyd's, and will be fitted with triple-expansion engines of 200 N.H.P., two steel boilers with a working pressure of 160 lbs. per square inch, water ballast, patent steam windlass, steam winches, steam steering gear, crane for lifting anchors, steel masts, and all the most approved appliances for facilitating the loading and discharging of cargoes and navigating the vessel. This vessel is owned by the Indo-China Steam Navigation Company of London and China. She is constructed with a topgallant forecastle and bridge-house, in which the superior and petty officers are accommodated, and a large deck-house aft, in which accommodation is provided for first-class passengers. The whole of the 'tween decks are available for steerage passengers, and are well ventilated and lighted through side with opening scuttles. This vessel is intended to trade on the China coast. The construction and outfit of the vessel and engines have been carried out under the supervision of Captain George M'Bain and Mr. Lang, engineer. The christening ceremony was performed by Mrs. Keswick, wife of one of the directors.

LAUNCHES.—Irish.

Macgregor.—On January 28th Messrs. Workman, Clark and Co., Spencer Basin, Belfast, launched a screw steamer named *Macgregor*, built to the order of Messrs. Colvils, Lowden & Co., Glasgow, and is the sixth vessel built for them by this firm. The new vessel is entirely constructed of steel, rigged as a schooner, with yards on the foremast, and has been built under special survey to class 100 A1 at Lloyd's. She has been specially designed for the American fruit trade, principally to carry bananas from Belize to New York, and has been fitted with all the latest improvements to suit her trade. There are three laid wood decks to prevent crushing of her delicate cargo. Mechanical ventilation with forced draught has been introduced into all her holds and saloon, thus securing a cool current of air for the preservation of the fruit when stowed closely in tropical weather. There is accommodation for 30 first-class passengers in a bridge-house amidships. The officers are berthed in wing houses aft of the bridge, and the crew in a forecastle under the awning deck. A cellular double bottom, for carrying water ballast, has been constructed all fore and aft. The dimensions of vessel are:—Length 215 ft.; breadth 32 ft.; depth of hold to floors 21 ft. 3 in., with a gross tonnage of 1,040. The engines are triple-expansion, of 1,500 I.H.P., cylinders 22 in., 35½ in., and 57 in. diameter; stroke, 3 ft. 9 in. Steam will be supplied by two steel boilers, at a pressure of 160 lbs.

Holkar.—On February 11th Messrs. Harland & Wolff launched from their shipbuilding yard, Queen's Island, Belfast, the steel sailing ship *Holkar*, for Messrs. Thomas & John Brocklebank, of Liverpool. The *Holkar* is a sister ship to the *Sindia*, recently constructed by the same firm, and is of the following dimensions:—Length, 318 ft.; breadth of beam, 45 ft.; depth, 26½ ft.; gross

tonnage, 3,073, and will class 100 A1 at Lloyd's. The vessel will have three deckhouses built of iron: the after one containing accommodation for the petty officers and apprentices, the midship one will be occupied by the seamen, and the forward house encloses the galley and a large boiler for driving the steam winch, steam windlass, capstans, and pumps. There are four cargo hatches, and all the most approved appliances for the quick loading and discharge of cargo. The *Holkar* is the tenth vessel built for Messrs. Brocklebank by Messrs. Harland & Wolff.

LAUNCH.—Swedish.

Meteor.—On January 4th a new salvage and diving steamer was launched by the Lindholmen Engineering and Shipbuilding Company, Sweden. She has been built for account of a Reval firm, and will be stationed at that town. The new steamer, which has to be ready for delivery in the middle of April, has a length of 155 ft., breadth 26½ ft., and depth of 14½ ft. The engine is of 160 N.H.P, non-compound, with surface condenser. The steamer will be fitted with a large centrifugal pump and several other appliances for diving, &c. The new boat has been named the *Meteor*.

TRIAL TRIPS.

Torre-del-Oro.—On January 21st the new steamer *Torre-del-Oro*, recently launched by Messrs. Craig, Taylor & Co., was taken on her trial trip. The boat has the following dimensions: 240 ft. by 32 ft. by 18 ft. draught. A speed of 11·1 knots was attained, and the engines, which developed 790 I.H.P., worked smoothly and well. These are of the triple expansion type, having cylinders 18½ in., 29 in., and 48 in. in diameter, by 36 in. stroke, and have been supplied by Messrs. Westgarth, English and Co., of Middlesbrough.

Nicolas.—On January 30th the new screw steamer *Nicolas* went to sea from the Tyne for a trial trip. The vessel is 212 ft. long, 30 ft. broad, and 14 ft. draught, and has been built by Messrs. Wood, Skinner & Co., Bill Quay, for the Russian Company of Sea and Land Conveyance, and she is a sister ship to the *Platow*, recently built by the same firm for the same owners. The engines are built by the North-Eastern Marine Engineering Company, Wallsend, and are the fourth set built by them for the same company. They are of three-crank triple-expansion type, having cylinders 17 in., 28 in., and 46 in. diameter, and 30 in. stroke, and include all the most modern improvements. During the trial the engines ran at 102 revolutions without the slightest hitch, and great satisfaction was expressed with the machinery, the speed obtained, viz., 10½ knots, being half a knot in excess of the guaranteed speed.

Age.—On February 6th the steamship *Age*, built by Messrs. Edward Withy & Co., West Hartlepool, ran her trial trip with 3,600 tons cargo on board, when satisfactory results were obtained. The vessel has large carrying capacity, employing all modern improvements and appliances to facilitate loading and discharging large cargoes. She is 290 ft. in length, 38 ft. beam, 19 ft. 6 in. depth; gross tonnage, 2,290. She is constructed throughout of steel on the cellular bottom principle (Withy & Sivewright's patent), in conformity with Lloyd's A1 class, and under special survey. In the main and after holds the web frame principle has been introduced, which dispenses with all hold beams, as well as affording increased strength, thereby enabling the vessel to carry cargoes of the most bulky description, such as machinery, torpedo boats, large guns, &c. With a view towards further increasing the strength of the vessel, nearly all the shell plates are in 24 feet lengths. Four powerful steam winches are fixed on to each hatch, and a patent windlass on forecastle head. A great improvement in the anchor arrangement and fittings, compared with the old plan, has been adopted, viz., stockless anchors, hauling into the hawse pipes, which can be worked by one man at the windlass. The poop is fitted up with saloon and cabin accommodation for officers and a limited number of passengers. The machinery, which is supplied by Messrs. T. Richardson & Sons, West Hartlepool, is of the triple-expansion type, embodying all their latest improvements; cylinders 21½ by 35 by 59 in. and 39 in. stroke, and it is expected very economical results will be obtained. Steam is supplied by two large cylindrical boilers, having a working pressure of 152 lbs. per square inch, and are constructed throughout of Siemens-Martin steel, in conformity with Lloyd's requirements for the above pressure. The vessel has been purchased by Messrs. Kinghorn Brothers, of Glasgow and Liverpool, representing Messrs. William Howard Smith & Sons (Limited), Melbourne.

Narcissus.—On February 8th the new steel armour-plated cruiser *Narcissus* left the Nore for the official forced draught trial of her machinery, and returned to Sheerness at night. The results were highly satisfactory, the mean I.H.P. developed being 8,574, and the maximum 8,826, with a speed of 19 knots. The machinery will now be accepted from the contractors, and the *Narcissus* will be completed for foreign service.

Lady Ailsa.—On February 11th this steamer, recently launched by the Ailsa Shipbuilding Company for Messrs. J. & A. Wyllie, Troon, had a successful trial run down the Firth. The speed obtained was over 10 knots. Her dimensions are 240 ft. by 33 ft. by 18 ft. moulded; gross tonnage, 1,200. She has triple expansion engines having cylinders 17 in., 27 in., and 44 in. by 36 in. stroke, 600 I.H.P., fitted by Messrs. David Rowan & Son, of Glasgow. The *Lady Ailsa*, after the trial, proceeded on her voyage to Genoa with a full cargo of pig-iron and coals, having over 1,600 tons dead weight on board.

Godmunding.—On February 13th the new screw steamer *Godmunding*, launched recently by the Blyth Shipbuilding Company (Limited), of Blyth, had a successful trial trip at sea. This vessel, which has been built for John T. Matthews, Esq., of the firm of Messrs. W. Lamplough & Co., of London, is of the following dimensions:—242 ft. by 33 ft. by 18 ft., and has long raised quarter deck, bridge, and topgallant forecastle, iron decks, and full outfit, including Harfield's patent windlass, Smith's steam winches, Donkin & Nichols' steam steering gear, Davis' compasses, &c. The engines, which are triple expansion, and of about 700 H.P., have been supplied by the North-Eastern Engineering Company, of Wallsend. The trials of speed gave the greatest satisfaction to all on board. The ship and engines have been built under the superintendence of Mr. J. C. Jobling, superintending engineer, of Newcastle, and of Lloyd's surveyors, and the commander of the *Godmunding* is Captain Lester, of London.

Moor.—On February 15th the Union Steamship Company's Royal mail steamer *Moor* underwent her speed trial at Stokes Bay, when she attained a mean speed of 16 knots per hour, and indicated 4,532 H.P. The engines worked at 70 revolutions per minute with a pressure of steam in the boilers of 160 lbs. per square inch. Compared with the *Moor's* performance on trial with compound engines, this shows an increase in speed of three-quarters of a knot per hour, and an additional 232 I.H.P. The *Moor* has just had her engines converted to the triple-expansion system, making the fifth of the company's mail steamers which have been so dealt with. The work has been executed by Messrs. T. Richardson & Sons, of Hartlepool, who have supplied the *Moor* with new boilers working at a pressure of 160 lbs. per square inch. The diameters of the cylinders are 34 in., 56 in., and 90 in. respectively, and the length of stroke 60 in. Whilst the operation of the *Moor's* engines was proceeding, advantage was taken of the opportunity to fit her throughout with a complete installation of electric lighting. All dining saloons, cabins, smoking rooms, &c., are now lighted in this manner, and the work has been carried out by Messrs. Siemens Bros. & Co. Arrangements have been made for fitting a similar installation to the other mail steamers of the company. The *Moor* has further been supplied with a refrigerating machine and cold chamber by Messrs. Haslam & Co., of Derby, which will ensure for passengers a constant supply of ice, fresh meat, provisions, &c., which will be shipped in England and preserved throughout the voyage. The *Moor* is well known to the Admiralty, having been engaged in 1885 for service as an armed cruiser. On that occasion she was supplied with an armament of six guns and 110 officers and men, and under the orders of the Commander-in-Chief on the Cape station, was sent on a cruise up the East Coast of Africa. The *Moor* was the only merchant vessel which actually armed and hoisted the pennant, or was commissioned under the command of a naval officer. She is also well known in the Cape of Good Hope trade for her very rapid passages, she having made the outward voyage in 18 days 10 hours, and homeward in 17 days 21 hours steaming time.

Boadicea.—The *Boadicea* has made a second full-power trial at Portsmouth. The two hours' run proved a remarkable success. The vessel was in very light trim, her mean draught being 20 ft. 6 in. The mean pressure of steam in the boilers was 69½ lb., and the mean revolutions were 72½. The collective I.H.P. was 5,073½, which was about 250 horses more than were obtained on her first commission trial, and only fell 56 below the mean developed at the contractor's run twelve years ago. The speed realised on the trial was just over 14½ knots.

Phœnician.—A series of most successful trials has been made with another vessel whose machinery has just been converted from

ordinary compound to quadruple expansion, on Mr. Walter Brock's (of Messrs. Denny & Co., Dumbarton) system. This steamer, (the *Phœnician*) belongs to Messrs. J. & A. Allan, of Glasgow, who are making extensive alterations to their fleet by way of modernising its machinery. The original cylinders had diameters of 39 in. and 68 in. respectively, while the new cylinders are 19½ in., 27½ in., 39 in., and 55 in., stroke in both instances being 42 in. Steam is supplied by one double-ended boiler with six furnaces, the working pressure being 170 lbs. per square inch. The trials made have justified all the expectations which Messrs. Allan had formed. The smoothness and regularity of working of the engines as converted were perfect, and the vessel maintained under easy steaming a speed of 11½ knots per hour, although the weather conditions were anything but favourable. The indicated power developed amounted to 1,200 horse, the revolutions were 68 per minute, and the boiler pressure was 170 lb.

Correspondence.

[*It must be understood that, in giving insertion to communications under this heading, we do not in any way pledge ourselves to the opinions preferred therein. We will with pleasure insert any letters likely to benefit our readers, either from their intrinsic value or as being calculated to promote such discussion as will elicit facts valuable from their being the result of practical experience.*—Ed. M. E.]

TYZACK'S STOCKLESS ANCHOR.

To the Editor of The Marine Engineer.

Sir,—I would feel obliged if you will kindly insert in your next issue the following note, in refutation of a report, prejudicial to my patent anchor, which I find is being maliciously circulated amongst shipowners and others.

On board the s.s. *Elingamite* named, there were other stockless anchors tested at sea, besides one of my patent, and whatever may have been the result of such testing as regards the others, the subjoined note makes the matter clear as far as mine is concerned.

Feb. 17th, 1888. (Signed) G. TYZACK.

[Copy of Letter.]

"C. S. Swan & Hunter, Shipbuilders,

"Wallsend-on-Tyne, *4th January*, 1888.

"This certifies that Tyzack's anchor was tested in my presence by backing steamer astern when out at sea, with the ss. *Elingamite* (4,000 tons D.W.), *and proved to hold well;* also stowed well in hawsepipe, size 15 in. diameter.

"(Signed) ARCH. BUCHANNAN,
"Yard Manager."

AN ENGINEER OFFICER.

To the Editor of The Marine Engineer.

Dear Sir,—Will you kindly oblige me, and my friends, by inserting this in your valuable paper, of which I am a constant reader; and having read of late much about the position of the marine engineer and ships' officers, I have given the subject some earnest, honest thought, and I have been surprised to find the evil spirit that exists with the officers towards the engineer.

The cause, I believe, is jealousy; the effect is annoying and disagreeable; the cure is to come, and it is my object to propose something that will assist its coming.

I have seen a great deal of this so-called superiority, and I, like many others, am at a loss to understand wherein it lies. I am seen sometimes in a boiler-suit, and with dirty hands, and as a mechanic that wishes to see and know how things are going on; and as metals, oils, coals, &c., are dirty things, we can't help getting our hands and clothes dirty, but we don't mind it, as it is for honest and necessary duty; but because we don't always appear on deck clean and fit to go to the dinner-table, we can't be gentlemen.

This is rather annoying to honest, sober, straightforward men, that are able to take the raw materials—steel, iron, or brass—and, by their brain, hands, and a few tools, in a short time make it fly into shape at their will, and then be attached to the mass of mechanism which brings interest to his employer, and credit to his profession.

My opinion is that if engineers would study their own characters, and the three great principles—cause, effect, and cure—and let their brain fulfil its proper position as overseer and controller of all the other members of their body, we should carry with us a power that would defy the ignorant, and gain a welcome from the sensible and wise. The word "gentleman" explains itself—a "gentle" man; a man that is gentle in all his ways, ready at all times to do an act of kindness to any one that is deserving; a man who carries with him an example that defies all with whom he has dealings, or lives with, to bring a charge against him that will stand the test of an honest tribunal, one whose behaviour will fit any good society; one that says what he means, and means what he says, and is not afraid to hear to-morrow what he has said to-day.

The word "officer" is a very fine word, and I like it very much, and I often hear it said, when in conversation, "Who is he? an officer?" "No, an engineer." "Oh! I don't know him." Now, I think he is an officer as much as any other, and my opinion is that we should have attached to our profession the word "officer." We should get our wives, sweethearts, and friends, to direct our letters, "Mr. ———, Engineer Officer of the s.s. ———;" then the distinction would be "engineer officer" and "ship officer."

Fancy, dear sir, a thorough honest, sober, and industrious engineer, that has added a good man's share to make the world what it is, and no one able to bring a charge of ungentlemanly conduct against him; yet, for the fact of his being a "craftsman," he can't be a gentleman! I believe the word refers to conduct, and good behaviour, and politeness. It would sound very strange to say that he is a "drunken," or "blackguard," or "dirty-mouthed," gentleman—a man not fit to be in company with respectable people.

I hope some of my learned brethren will give an opinion on the subject, and be able to get the Board of Trade to sanction it if it be necessary, as I am of opinion it will redound to the good of all, without injury to anyone. Kindly excuse the brevity of my letter; it may prove a word in season to bring out some good advice from our learned friends, and also to give a better understanding of the misunderstood word "gentleman."

I am, dear sir,
Yours sincerely,
A Lover of Truth and Justice,
AN ENGINEER OFFICER.

[We will excuse our correspondent's "brevity" for once, but we really cannot open our columns to the discussion of the meaning of any particular word; and we must ask our correspondents to adhere more to the main question, and not drift into such side issues.—Ed. M. E.]

ENGINEERS AND MATES.

To the Editor of The Marine Engineer.

Sir,—A short time since I replied to a letter written by a mate published in the *Shipping Gazette*. Some of my friends and readers of your journal suggested that these letters should, by your permission, be published in your journal, which would enable our sea-going Engineers to peruse them who would possibly not see them in the *Shipping and Mercantile Gazette*. With this in view, I ask you to kindly publish the two letters enclosed, thanking you again for past favours.

Yours truly,
WM. F. OWENS.

To the Editor of The Shipping Gazette.

Sir,—I wish to offer a few remarks on the positions held and pay received respectively by engineers and mates in the merchant service. In the first place, I would have it fairly understood that my object is not to lower the pay of the engineers, or to impose more duty on them than they have, but to open the eyes of mates that they may combine together to try and better their positions. I myself think that the mate of a steamer should be paid the same wage as the engineer. The engineer works four hours out of 12, the remaining eight hours he has for sleep and to get his food. The mate has to take his watch every four hours, and he has only four hours to sleep and get his food in. This is at sea. Now take their duties in harbour. The engineers begin work at 7 a.m., and leave off at 5 p.m., and on Saturdays they go off duty at 1 o'clock. This applies to everyone connected with the engineers' department. Officers and seamen are in a regular routine. They are called out at 5.30 a.m., begin work at 6 a.m.,

and do not leave off until 6 p.m., and many times are the mates up at 4 and 5 in the morning, and working, tallying cargo, or superintending loading or discharging. At the coal ports at home it is a common thing for mates and seamen to be about night and day, shifting and attending on the ship, whilst the engineers and firemen are gone to their homes, and get a comfortable night's rest. On what grounds, tnen, should engineers receive so much more pay, or work less hours, than the mates? Are they better men in their department than the mates are in theirs? If almost any little thing gives way, can or do they repair it? If they do, it is a patched-up job that has to be done over again as soon as the boat is in port. Now, Sir, the sooner the officers form themselves into an association, not to pull the engineers' wages down, or to lengthen their hours of labour, but to lift themselves up on a level with them, the better. I, for my part, see no reason why mates and seamen should be compelled to work 24 hours to a day any more than any one else, unless they are paid for so doing. Engineers have an association, and I hope all engineers will join it; but I should very much like to hear of an association being formed for mates, which captains should join as well. I fully believe if an association was formed, there would be a great many respectable owners who would give it their support.

Yours, &c.,
ONE OF THE MATES.

Dec. 9th, 1887.

To the Editor of The Shipping Gazette.

Sir,—For the information of steamship owners and others interested in merchant steamers, I beg to reply to the mate's letter published by you on December 20, 1887. Statements made by that gentleman are not true, and might possibly lead persons ignorant of engineers' duties to suppose that engineers really had a splendid time of it on board ship. The mate says that engineers work only four hours out of 12 at sea. I will show how they work considerably more. For example, take an ordinary modern cargo steamer of 3,000 tons. She will be provided with at least four steam winches, steam steering gear, and steam windlass. Now, Sir, these engines are kept in working order by the engineers of the ship, that is to say, they are packed, working parts adjusted, steam valves and pipes in connection with these engines kept tight, and, I may say, that where deck steam pipes are exposed to the wash of water on deck the joints require to be frequently remade, the donkey boiler has to be attended to, to prepare it for work in harbour, boiler washed out, safety valves, gauge cocks, &c., examined. This, if not done, would be sure to cause a stoppage while discharging or loading cargo. The whole of the before-mentioned work is done by the engineers out of the "eight hours off," as my friend thinks fit to call it. I am of opinion that the mate has had a very limited experience in steamers to compare his duties with that of engineers. I can assure the mate that he would find eight hours in the engine-room, out of 24, quite enough in the Red Sea, with the thermometer at 120 deg., or crossing the Western Ocean in a heavy gale, in a light ship, he would find behind the weather cloth on the bridge more pleasant than in the engine-room, and the extra pay well earned by the engineers. Now take their duties in harbour. I grant that the engineers work from 7 a.m. to 5 p.m., and a fair day's work can be done in that time. The mate is very unfair in what he states; he should have stated that the engineers work two hours less per day in harbour, but when the ship is at sea on Sundays the engineers have to push the ship along as fast on that day as any other. The mates are exempt from their usual work of repairing sails, painting ship, &c. Again, the work of engineers means being about 30 ft. from the pure air on deck, repacking pumps and adjusting the various working parts of the engines, &c., while the work of the mate consists of sitting on a cask or corner of the hatch with a pencil and book tallying cargo. In conclusion, I think it bad taste of the mate in stating that he should be paid the same wage as the engineer, simply because the engineer has it. I take it that owners do not think so, or he would get it; and when he is comparing the engine department with the deck, he should state the whole of the facts connected with both, if he knows them, or leave it to some one who does. I might state more, but I think the before-mentioned sufficient to show that engineers have not lazy times of it at sea or in harbour, as the mate's letter represents.

Yours, &c.,
WM. F. OWENS.

Jan. 6th, 1888.

CHINESE SOAPSTONE.

To the Editor of The Marine Engineer.

Sir,—Referring to the difficulty which is being experienced to protect steel vessels against rusting, and which yours as well as many other shipping journals have at times referred to, I think it may be of value to the shipowning community, shipbuilders, &c., to inform them that I have for some time experimented with a material called *Chinese Soapstone* as a substitute for the ordinary metallic pigments used in paints, and that I have found this soapstone to possess qualities highly calculated to prove an effectual remedy against this danger of rust. In China soapstone is largely used for preserving structures built of sand, and other stones which are liable to crumble under atmospheric influences; and the covering of powdered soapstone in the form of paint on some obelisks in China, which were hewn out of stone liable to suffer under atmospheric influences, has been known to preserve the same intact for hundreds of years. Soapstone may therefore be said to have extraordinary qualities in withstanding atmospheric influences, which have a great deal to do with the corrosion of steel and iron, for it is well known that the inside of a steamer, which is not exposed to the incessant action of salt water like the bottom, corrodes very much more quickly than the outside. Soapstone has, however, another quality which eminently adapts it as a pigment for protective paints on steamers, that is, the extreme fineness of its grain; ground soapstone is one of the finest materials which can be produced, and from the experiments which I have made, I have found nothing to take hold of the fibre of iron and steel so easily and firmly as soapstone. It is, moreover, lighter than metallic pigments, and if mixed as a paint, would cover a larger surface than zinc white, red lead, or oxide of iron.

It seems that in the manufacture of paints and varnishes the Chinese and Japanese are a long way ahead of us, but I trust that this hint may induce some one in the trade to make experiments with a view of combining soapstone as a protective paint, which I feel certain would be well adapted to prevent rusting on the inside and outside of iron and steel ships, not to speak of other structures, buildings, woodwork, or anything else which suffers from the effects of the atmosphere.

I am, Sir,
Your obedient servant,
FRANK C. GOODALL,
Surveyor of Shipping to the Trinity House.
12, Larkfield, Richmond, S.W., *February 14th*, 1888.

THE MARINE ENGINEERS' UNION.

To the Editor of The Marine Engineer.

Sir,—In your last impression there appears a letter from Nagasaki, signed "Ohio," which principally deals with the question of the Marine Engineers' Union extending its operations to countries abroad; and, although it may be well known by this time in both China and Japan as well as in India, that arrangements have already been made for extending the operations of this society, it may interest your correspondent, and many others besides him, to learn that such arrangements are now nearly completed, and that probably before this number reaches him the Shanghai and Singapore Institutes, while retaining their present independent character, will have become incorporated with the Marine Engineers' Union. Hong Kong, Yokohama, and Bombay are now being arranged for, and when these places have been duly provided for, other ports abroad will come in for a due share of our attention.

Your correspondent "S." is quite sound in his opinion regarding the Union and its effects upon our profession, but he is decidedly in the wrong when he states that its aims are aggressive. If he will kindly refer to my previous letters, he will find its aims and policy so clearly expressed that he will see the Union is anything but aggressive. The Union has been founded for something more than merely to hold meetings and hear papers read; these are all very well in themselves, but they are not all that is wanted to raise the social status of Marine Engineers.

It may be news to your correspondent to learn that the Union already numbers in its ranks some of the very best men in the service, besides a very large number of young men who are possessed not only of a liberal education, but of accomplishments sufficient to entitle them to stand side by side with the best in the land. It appears to me that your correspondent has had the Union presented to him in a very distorted form by some of those ubiquitous people who are ever ready to misrepresent whatever is good or promises to remedy existing evils.

The letter of "Progress" (Constantinople) contains much that is earnest and practical in the way of advice; but I am sure he will excuse me if I point out that the Union does not embrace all classes of marine engineers as its members, and a perusal of its prospectus will show why. I may tell him, however, that although our members are all certificated marine engineers, they are to be found in all the classes of steamers he names, from P. and O. mail boats to ordinary ocean tramps, as he calls them. This shows that the Union, while careful in its selection of members, is thoroughly representative, and consequently ought to be successful. Your correspondent is very far at sea with regard to the rule referring to unemployed members; and I can tell him that the party who gave him such an explanation of the rule ought to be avoided, as an enemy to engineers, no matter though he may be found at present in their ranks. There is no rule enforced with greater strictness than that referring to insobriety, and every possible means are employed to prevent men of known unsteady habits becoming members.

This fact is already known and appreciated by many owners and superintendents. The question whether the Union is to be used as a strike machine is a weak invention of the enemy, which "Progress" may dismiss at once when he is informed that in my letter of December the policy of the Union is distinctly stated to be one of conciliation, not aggression; and, as we have already made considerable headway under this same policy, we would be worse than foolish were we to abandon it now. The remainder of this correspondent's letter looks more as if it had been dictated by one of the leading members of the Union than by a brother so far away, it corresponds so closely with the opinions and sentiments which prevail amongst our committee and members; and, should I ever have the opportunity of meeting him in person, I hope to be able to convince him that his opinions have already to a great extent been put into actual practice.

It has again been my good fortune to be present at the opening of two new branches of the Union, the first being in Rotterdam on the 9th February, and the second being at Jarrow on the 17th. The Rotterdam branch has been some months in existence, and in quite a flourishing condition, but the election of office bearers and formal opening had to be delayed to suit other arrangements. We had a very interesting meeting, and those present were much pleased with the club room provided for the use of that branch. The Jarrow branch is of more recent formation, but is quite as healthy and vigorous as any of its elders; and as the committee have been fortunate in securing most eligible club rooms in a new building in the principal street, they will have every advantage in carrying on their operations in that important district.

Our anticipations as to a further increase in numbers have been more than realised—the number, 1,480, mentioned in my last letter, having now increased to over 1,780, or an addition of more than 300 members during the past month.

With best thanks for your courtesy, I remain,

Yours very truly,
THE HONORARY CHIEF SECRETARY,
Marine Engineers' Union.

Chief Offices: 91, Minories, London, E.
24th February, 1888.

To the Editor of THE MARINE ENGINEER.

SIR,—In reference to my letter which you have been kind enough to print in this month's issue, I must ask you to announce that I have no connection with the "Progress" of earlier issues, with whose sentiments I do not at all agree. If it should become necessary for me to answer the criticisms which I cannot expect to escape, will you in future kindly allow me to sign myself,

Yours respectfully,
UPWARDS AND ONWARDS?

P.S.—Later information which I have received has relieved many apprehensions which I entertained regarding the Union.

ANTWERP, *Feb. 6th*, 1888.

PATENT LIFE RAFT.—Messrs. J. F. Waddington and Co., ship and launch builders, Seacombe, are at present constructing an "Alvarez" patent life raft, sea anchor, and jury rudder, combined for the South American Government. It consists of two side and two end tanks of steel, which, when not in use, form seats on the ship's deck, while the bottom of the raft, which is of wood, forms the jury rudder. The raft will also be fitted with mast, spritsail, and jib, and is self-righting.

Miscellaneous.

THE FASTEST PASSAGE FROM THE CAPE.—The Union Steamship Company's R.M.S. *Tartar*, which left Cape Town at 5 p.m. on the 25th of January, and Madeira at 9 p.m. on the 8th February, arrived at Plymouth at 4.42 p.m. on Sunday, February 12th. This passage is the fastest yet made between Cape Town and Plymouth, the total time between Cape Town and Plymouth being 17 days 23 hours 37 minutes; and the net steaming time, after deducting stoppages, being 17 days 17 hours 7 minutes.

CONTRACTS, DREDGER PLANT.—In connection with the Manchester Ship Canal, for which work he is the contractor, Mr. T. A. Walker is procuring an extensive dredger plant. Two dredgers (a hopper dredger and a screw propelling barge loading one) have been ordered from Messrs. W. Simon & Co., of Renfrew, and a third is to be supplied by Messrs. Fleming & Ferguson, of Paisley. The latter will be propelled by twin-screws, and is to be capable of raising 600 tons per hour from a depth of 35 ft., cutting its own floatation if required. The engines are to be the builders' patent quadruple expansion type, indicating 700 H.P.

A REMARKABLE VOYAGE.—The *Morning Star* steamer, to be employed in landing passengers at Algoa Bay, arrived at Cape Town on January 30th, from England, *viâ* Lisbon, Las Palmas, Sierra Leone, Lagos, and St. Paul de Loanda. The *Morning Star* is the smallest steamer which has ever made the run from England to the Cape. She was designed by her owner, Captain R. Duncan, of London, and was built at Leith, by Messrs. Marr Brothers, her engines being supplied by Messrs. H. H. Morton. She is 26 tons yacht measurement, is of teak, copper fastened, and is classed A1 at Lloyd's. Her length is 50 ft. between perpendiculars, over all 56 ft., with 11 ft. 2 in. beam, and 5 ft. 6 in. depth of hold.

TRIPLE EXPANSION ENGINES.—An interesting example of the value of triple expansion engines, as compared with compound, was exhibited on the Clyde, on Saturday, January 28th, on the trial of the Orient liner *Cuzco*, which has recently been thoroughly renovated by the Fairfield Shipbuilding and Engineering Company, and furnished with new boilers working with a pressure of 150 lbs. to the inch, and with triple expansion engines of the most approved type. The *Cuzco* is 17 years old, and has hitherto been regarded as a 12½-knot boat. On Saturday she was tried on the measured mile for a six hours' run, when she attained a speed of 16 knots, and made upwards of 75 revolutions per minute. This increase in speed was accompanied with the usual economy in coal consumption, and the incident is remarkable on account of the success with which the power of the new engines has developed a high speed in a vessel the model of which is comparatively obsolete.

EXTRA CHIEF ENGINEERS.—Three pupils of Mr. John Leckie, Leith, passed as Extra Chief at one examination last month. We believe this is the first time that so many have passed at one Board of Trade examination.

THE RUSSIAN IRONCLAD ADMIRAL NAKHIMOFF.—The lates addition to the Russian ironclad fleet, the Admiral Nakhimoff, has been found to be useless as at present constructed, and it will have to undergo alterations amounting almost to complete reconstruction before the ship can be put into commission.

Recent Applications for Patents connected with Marine Engineering, Ship Construction, and Mechanical Appliances for use in Ships, from January 13th to February 16th, 1888.

560 A. E. Barthel and J. C. J. Möller. Projectiles.
601 S. Hallam, H. Stevenson, J. Webb, and F. W. Ewen. Engine valve gear.
634 W. W. Parker. Lifeboat.
641 W. G. Armstrong. Fuses for projectiles.
672 Newton (G. Allman). Life-saving rafts.
675 D. J. Morgan. Steam engine pistons.
683 W. C. A. Holzapfel. Composition for protecting vessels.
690 J. A. Aniello. Lifeboat.
695 H. P. Fenby. Corrugated boiler flues.
696 T. Varley. Ships' propellers.
697 W. Sisson. Valve gear of oscillating engines.
724 A. Higham. Marking strip for boiler makers and iron shipbuilders.

733 J. Sanderson. Channel bar for ships' keels.
768 R. Duncan, jun. Forming ships' beams.
773 Justice (M. T. Davidson.) Triple expansion steam engines.
776 W. Bowman. Propulsion of ships.
815 H. Defries. Ships' signal lamps.
831 R. Baird. Steam engine packing.
836 W. Sharples. Working "Corlis" valves.
844 H. Lindley. Compound steam engines.
912 D. Purves, A. L. Jones, and W. J. Darling. Boiler plates.
916 T. Lockerbie. Slide valves.
978 H. Benjamin. Ships' boats, lifeboats, &c.
995 W. P. Hoskins. Ships' berths.
998 A. Thomson. Mechanical stokers.
1015 E. Barnes and Tangyes (Limited). Duplex pumping engines.
1031 J. Pain and A. A. Craig. Ships' signal lights.
1038 J. Rankine and J. P. Hall. Cleaning and preserving b iler furnaces.
1048 F. M. Sims and W. C. Nicholls. Keeping buoyant bodies at a certain depth below water.
1054 J. Rankine. Preventing furnaces collapsing.
1092 W. S. Simpson. Lighting from torpedo boats.
1101 J. O. Wallace and W. Ward. Compositions for coating submerged surfaces.
1137 Hunt (E. Henry). Twin screw propeller driving gear.
1196 J. Rettie, F. W. E. Gruggen, and H. J. Peachey. Utilising the power of water in motion.
1260 T. Halliday. Propelling boats.
1296 G. P. Thomson and J. H. Biles. Rolling chambers for ships.
1355 R. Howarth. Heating feed water for steam boilers.
1390 Imray (C. H. Stebbins). Distributing oil over rough water.
1397 M. Immisch. Propellers.
1402 J. Paterson. Testing engine crank shafts.
1415 G. Richards. Double acting steam engines.
1426 C. S. Madan. Steam jet pumps.
1438 J. Black and T. Cameron. Letting go flare signals and life buoys.
1446 L. Vojácek. Centrifugal pumps.
1448 J. Stead and T. L. Roberts. Screw propeller.
1460 W. Jefferson. Ships' davits.
1467 C. A. Marshall. Seamless tube.
1498 J. Moore. Propulsion of steam vessels.
1502 J. S. Burberry. Boats and vessels.
1565 S. Butler. Shipping coal.
1585 A. Hickman and J. Shelton. Propulsion and steering of boats.
1590 W. G. Nicholson. Lessening frictional resistance to vessels moving through water.
1609 J. D'Arcy-Irvine. Throwing a line or cord for saving life at sea.
1652 J. Standfield. Steam ferry boats and landing stages.
1670 F. J. Sinnette. Anchor.
1685 A. Brock. Ships' signal lights.
1713 J. T. Bucknill. Firing torpedoes.
1756 J. W. V. Brierley and C. F. Gee. Steering apparatus.
1789 R. Potter. Marine speed register.
1793 D. Johnston. Preventing corrosion of screw-propeller blades.
1795 R. Richardson. Steam and hand-steering gear.
1817 G. Taylor. Shipping coal, &c.
1822 J. Bondkowski. Pumping machinery.
1834 J. Bramall. Propelling and steering boats, &c.
1838 Lake (J. W. Mansfield). Ships' masts or spars.
1852 J. P. White. Utilising the flow and ebb of tides.
1867 S. E. Howell. Boiler tubes.
1877 A. Macpherson. Launching, lowering, &c., ships' boats.
1879 J. Higham. Propelling boats, &c.
1881 H. O. Arnold-Forster. Protecting ships against torpedoes.
1908 Thompson (C. J. Pigeon and L. J. T. Lacroix). Ships' mattresses.
1912 J. Barnier. Motor.
1931 W. J. Ewing. Stopping vessels to prevent collision.
1935 T. J. Gray and E. E. Arkless. Cleats for ships' hatches.
1998 Leigh (J. N. Le Sollieo). Screw propellers.
1999 W. R. Freeman. Screw propellers.
2018 J. C. Bethams. Ships' armour.
2024 J. H. Tordoff. Furnace flue, tubes, and fire boxes.
2082 J. T. Baharie. Life raft.
2115 M. T. Neale and J. H. Smalpage. Signalling at sea.
2157 S. Coleridge. Mooring torpedoes, buoys, &c.
2201 A. W. Kiddie. Propelling boats, &c.
2212 W. C. Wallace and R. D. Smillie. Preventing corrosion in propellers of ships.
2237 W. P. Logan. Post anchors.
2245 N. G. K. Flusberg. Propelling mechanism for ships.
2302 S. A. Johnson. Ships' filters.
2323 J. Wishart. Steam valves.
2342 C. J. Henderson. Furnace boilers.

BOARD OF TRADE EXAMINATIONS.

EXTRA FIRST CLASS.

February 20th, 1888.	McCulloch, Wm.	Extra 1 C.	Leith.
,, ,,	Ramsay, David.	,, 1 C.	,,
,, ,,	Thompson, John	,, 1 C.	,,

NOTE.—1 C, denotes First Class; 2 C, Second Class.

January 28th, 1888.

Allen, Charles ..	1C	Aberdeen
Anderson, Thos...	2C	Sunderl'd
Baston, William..	1C	,,
Burn, Thomas ..	1C	,,
Carruthers, Wm.	1C	,,
Crowell, John J.	2C	N.Shields
Cruickshank, Jas.	1C	Aberdeen
Cunningham, John	1C	N.Shields
Dempster, A. H.	1C	Liverpool
Gall, Alexander...	1C	Aberdeen
Goulding, S. G...	2C	Liverpool
Greenhalgh, Wm.	1C	Sunderl'd
Harcuss, John ..	2C	N.Shields
Hudson, Thomas	1C	Sunderl'd
Hughes, Hugh ..	2C	London
Little, George ..	2C	N.Shields
Loveless, Chas. ...	2C	Sthmpton
M'Nab, James G.	1C	Liverpool
Palmer, A. G. ..	2C	N.Shields
Payne, Robert ..	1C	London
Pritchard, H. E.	2C	Liverpool
Rea, James Thos.	1C	Sunderl'd
Stevenson, Martin	1C	,,
Swallow, John C.	2C	Liverpool
Tate, Wm. M. ..	2C	Sunderl'd
Thom, C. M.....	1C	London
Watson, Andrew	2C	N.Shields

February 4th, 1888.

Allan, F. James..	2C	Glasgow
Bell, William....	2C	,,
Blackwood, J. T.	1C	N.Shields
Blundell, W. H.	2C	London
Collis, Edward C.	2C	,,
Cowan, Thomas..	1C	Glasgow
Cumming, J. C.M.	2C	,,
Drysdale, James..	2C	Liverpool
Edgecumbe, John	2C	N. Shields
Fairweather, D...	2C	Glasgow
Gow, John	2C	,,
Greenshields, Jas.	1C	,,
Gregor, John	2C	,,
Hughes, Joseph..	2C	Liverpool
Johnson, Arthur	1C	London
Kenny, William..	1C	Liverpool
Kerr, Alexander	1C	Glasgow
Langlands, David	2C	,,
MacCall, John ..	1C	,,
Moppott, C. G. ..	2C	Liverpool
Ogle, George	1C	N.Shields
Rivers, W. H. G.	1C	London
Rogers, George J.	1C	,,
Rogers, J. G.....	2C	Liverpool
Russell, John C.	2C	Glasgow
Stephenson, J. W.	2C	Liverpool
Williams, Wm. ..	1C	,,
Wilkins, R. F. ..	2C	London
Wymer, F. D. ..	1C	,,

February 11th, 1888.

Alles, Robert	1C	Liverpool
Barnes, Harry A.	2C	London
Brown, David C.	1C	Leith
Cain, Thomas H.	1C	Liverpool
Christie, William	1C	Leith
Cory Sydney	2C	Sunderl'd
Dobbyn, Samuel	1C	N.Shields
Drummond, Robt.	2C	Greenock
Dudgeon, F. S. ..	1C	London
Evans, David L.	1C	Liverpool
Evans, Lewis	2C	Greenock
Fairbairn, John..	2C	N.Shields
Gethin, Henry R.	2C	,,
Grieve, William..	1C	Leith
Kay, William ..	1C	Greenock
Kennedy, Henry	2C	Leith
Laing, Robert ..	1C	,,
Larsen, Harold ..	2C	Liverpool
Lewins, Frank ..	2C	N.Shields
Macaskie, John ..	1C	Leith
Macmurthie, Alex.	2C	Greenock
Milne, Robert ..	2C	Leith
Moffitt, Robert D.	1C	N.Shields
Mounteney, Geo.	2C	London
Pearson, Alex. ..	1C	Leith
Renwick, J. P. ..	2C	Liverpool
Richardson, John	2C	N. Shields
Sumner, Wm. F.	1C	Hull
Treasurer, R. S...	2C	Leith
Webster, Alex...	2C	Hull
Wilson, John H.	2C	London
Wrate, W. J.....	2C	Leith

February 18th, 1888.

Adams, George ..	2C	London
Alder, R.........	2C	W.H'pool
Armstrong, Henry	2C	,,
Arnold, E. S.....	1C	London
Band, Robert....	2C	N.Shields
Blanthorn, J. S...	1C	W.H'pool
Buckmaster, T. W.	2C	London
Chisholm, R.	2C	W. H'pool
Christopher, Wm.	2C	Plymouth
Cust, W. T.	1C	Liverpool
Duncan, Andrew	1C	,,
Double, Fred. W.	1C	London
Geipel, George ..	2C	W.H'pool
Green, John	1C	Liverpool
Hicks, John	1C	N. Shields
King, George....	2C	London
Marshall, James ..	2C	Greenock
Mawson, J. J. ..	2C	N.Shields
Rodger, J. T. ..	1C	London
Smith, James C...	2C	,,
Strathers, A. G...	2C	,,
Sturgeon, F. L...	2C	,,
Thorp, R. E.	2C	N.Shields
Tunstall, John ..	2C	Liverpool
Van Yserloo, J. H.	2C	London
West, William ..	1C	,,
Wood, Robert J.	2C	W.H'pool

733 J. Sa
768 R. D
773 Just
776 W. I
815 H. I
831 R. I
836 W.
844 H.
912 D.
916 T.
978 H
995 W
998 A
1015 F

1031 J
1038 J

1048

1054
1092
1101

1137
1196

126
129

13
13

1
1
1
1